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IN TOUCH WITH PEOPLE

United States Department of the Interior Conservation Yearbook Series No. 9
1973



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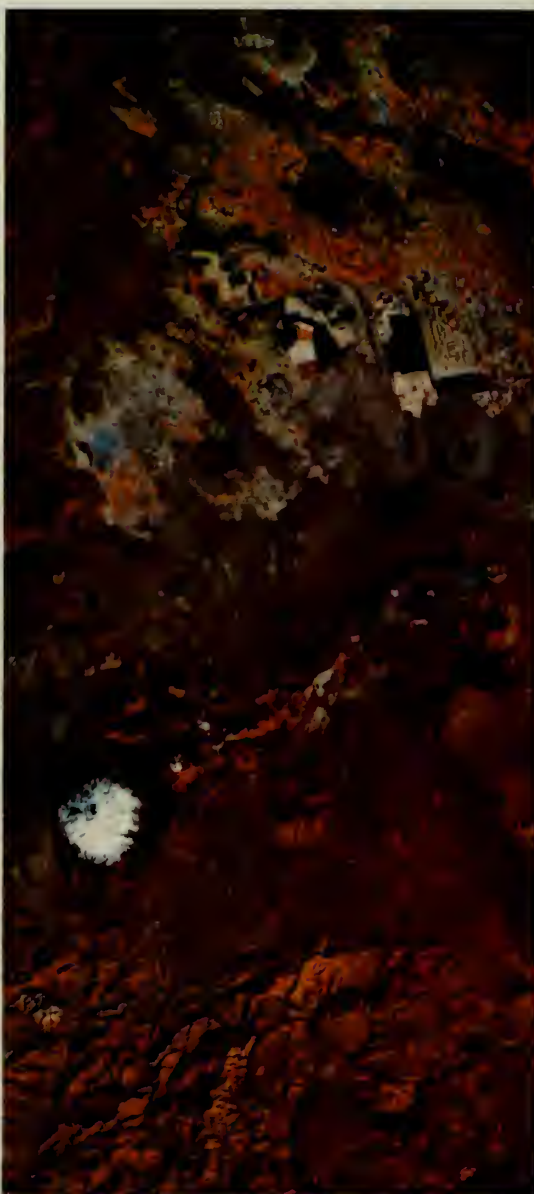
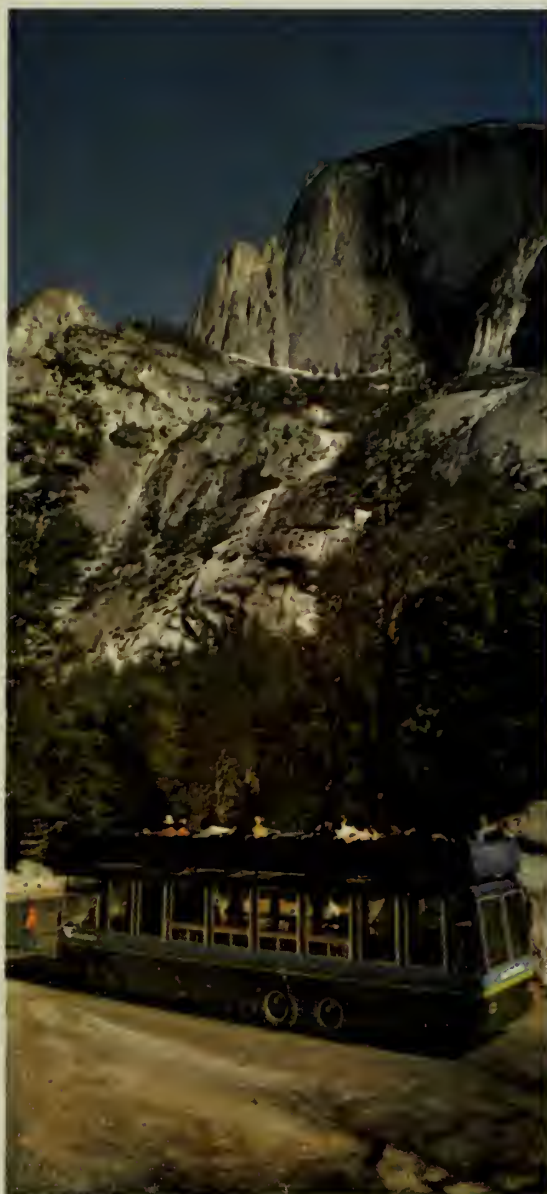
1973



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People are our Future

Across the United States — North, South, East, and West — overseas to Territories and numerous foreign lands — the Department of the Interior is in touch with people.

Since its beginning in 1849, public concern has developed into a commitment. That was the year the General Land Office, Office of Indian Affairs, Patent Office, and Census Office became part of the then new Department.

It can be said that people were our past, are our present, and will be our future. Policies and programs may be altered to meet changing conditions of this growing country, but contacts with people will flourish and generate mutual understanding and respect.

We have learned much along the way, and much remains to be learned. Not too many years ago, we joined other agencies of Government in listening even more closely to the people we serve.

We found it is infinitely better to weigh and balance the diversities of our environmental system in any particular area of involvement before instituting change, rather than after change is made.

From that knowledge a principle has ensued that will help assure increased appreciation for our resources and a safer passage from one generation to the next.

Although we savor our role as a people-oriented agency, we must give at least equal emphasis to Interior's role as the principal guardian of the Nation's natural resources.

Our natural resources — once thought a never-ending cornucopia — are not inexhaustible. Painful shortages, especially in oil and gas, already have occurred and will become worse before adequate solutions are found.

Therefore, it behooves us to conserve, develop, and use nature's gifts as wisely as possible. We know indisputably that the task of maintaining a balance between supply and demand grows more difficult each passing year.

We live in a single, interdependent biosphere where the flora and fauna, air and water, land and other resources must be carefully attended to maintain the balance of Earth's fabulous natural mechanism.

Conservation must be the common denominator that guides our objectives. There are many definitions of what it means, but one of the most succinct that appeals to me was given by Aldo Leopold, when he said:

"Conservation is a bird that flies faster than the shot we aim at it."

Outdoor people, especially, will have no difficulty in grasping his reasoning. If we stay ahead, we have an excellent chance of winning the race. If we recede, the chance of success is greatly diminished.

Interior's ninth Conservation Yearbook — "In Touch With People" — brings to mind many memorable experiences that lend emphasis to conservation and the myriad responsibilities shared with people.

One of our strongest recent challenges has been in developing improved ways to move people in the parks.

We are seeking the best ways to move people without injuring the parks. We cannot, of course, ever lose sight of the fact that we are charged with preserving the parks for generations ahead.

If we request you to park your car and ride a bus, or hike, it's because we want to save the park you are visiting. Last year the National Park System had more than 211 million

visitors, and the number of visitors increases each year.

With assistance from Mrs. Richard Nixon, about three years ago we inaugurated a "Volunteers in Parks" program that has brought us in touch with many people who love the parks so much they want to help others appreciate them.

At first, they came by hundreds and then by thousands — Americans of all ages — responding to a plea to work with park rangers to help visitors gain a better understanding of our parks. To the visitors they assisted and to us, park volunteers became Very Important People.

Of the 298 natural, historic, and recreation areas in the National Park System, some 150 had VIP programs in 1973, including Indians at Badlands, South Dakota; college students at Yosemite in California; and volunteer doctors on call at Wolf Trap Farm Park for the Performing Arts in Virginia.

One letter — perhaps more than any other — seemed to sum up the overall sentiment heard about the VIP program. It came from a California youth, who wrote:

"Instead of you thanking me, I would sincerely like to thank you. Last summer in the Tetons was probably the best summer in my life. Volunteering to stay and work in a mountain environment was just what I needed to completely cure a city-bred discouragement with Americans and America. I really think the VIP program did more for me than I did for it."

But Interior's focus goes far beyond the splendid areas of the National Park System. It touches such diverse areas as recreation and open space in our cities, rivers and trails, fish and wildlife refuges, mines and mineral resources, public lands, Indian affairs, development of knowledge about the earth, land and water resources, marketing of electric power, the arts, and the use of energy.

President Nixon's Legacy of Parks concept has added 46,000 surplus Federal acres to State and local governments for parklands and playgrounds. The areas vary in size from a single acre to thousands of acres, but each was selected because it will fill an important need of people.

Wildlife refuges are popular with both adults and children who seek relaxation or, perhaps, a lesson in history or ecology. Youngsters sometimes participate in a refuge's waterfowl banding operation, and it is a rewarding sight to observe eager eyes light up as youthful hands reach for the first duck they have ever held.

In 1973, thanks to Union Camp Corporation, the Great Dismal Swamp in Virginia was added as a new wildlife refuge. The Company donated 49,000 acres valued at \$12.6 million to The Nature Conservancy which, in turn, is conveying the property to Interior as a wildlife refuge.

This successful action ended a lengthy effort by citizens who wanted to preserve one of the largest and most significant remaining swamps in the eastern United States. It is home to at least 75 species of birds, black bears, the unique short-tailed shrew, and varied other forms of animal and plant life.

Actions by Interior in the field of energy touch the lives of all our people. Unquestionably, we must pursue a vigorous — but prudent — course of action just to keep up with demands for energy by America's consumers.

Quota restraints have been ended so more oil can be imported. Acreage leased on the outer continental shelf will be greatly expanded. Emphasis will be given to producing oil from oil shale and energy from geothermal resources. Research will be increased to accelerate development of low-cost, clean-burning forms of coal.

The Alaska pipeline is crucial to our fuels supply because it can bring as much as two million barrels of



Interior's responsibilities extend across the United States and touch a wide variety of lands and waters. Above, Secretary Morton is shown with group observing a demonstration at Blackwater National Wildlife Refuge, Maryland.

oil a day from the North Slope of Alaska to Valdez. I sincerely hope the pipeline will be started and completed as rapidly as possible.

Research is vital in energy and minerals. An example of such effort by Interior's Bureau of Mines gives striking reassurance. It concerns the Upper Midwest Iron Range, where Bureau of Mines metallurgists found ways to upgrade nonmagnetic ore to a commercially valuable concentrate. As a result of that discovery, a new iron mine and plant providing permanent jobs for 550 people are opening at Ishpeming, Michigan.

Geological Survey volcanologists have worked systematically for 25 years to unravel the geological secrets of Valles caldera, a complex depression 10 miles in diameter, near Santa Fe, New Mexico.

Largely on the basis of the Survey's mapping, an oil company is exploring and developing a geothermal steam field in the heart of the caldera. Valles caldera once had lava-covered slopes, but with trees and meadows its torrid volcanic past became apparent only to scientific eyes.

Interior's Bureau of Land Management administers 450 million acres of public lands, the leftovers of an original public domain of 1.8 billion acres. These are "National Resource Lands," a name adopted in 1972 to distinguish them from other categories of publicly owned lands.

National Resource Lands once had no stated purpose, but have become increasingly important to our future.

In Southwestern Montana is Humbug Spires, with upended granite shafts that tower hundreds of feet into the air, and still strain the credulity of people who walk among them. Humbug Spires has been set aside as a primitive area. The colorful list of "Jewels in the Crown" includes Calico Hills in Southern California (now part of our desert recreation assets); Powderhorn Primitive Area in Colorado's high country; Grand Gulch in Utah's canyonlands; and Birds of Prey Natural Area in Idaho, one of the vanishing habitats preserved for soaring hawks and eagles. These and other areas administered by BLM are spectacular reminders of the history of this continent.

Bringing water to change parched lands into fertile areas long has been identified as one of the benefits of water resources programs administered by the Bureau of Reclamation. Irrigation projects have brought livelihoods to many thousands of farm families in the West.

In southwest Colorado's spectacular mountain range is an alpine wonderland with 14,000-foot peaks known to many as the "Switzerland of America." Here, a different kind of water resource project is in progress. In the summer of 1973, meteorologists and others from Reclamation's Colorado River Basin Pilot Project prepared for the fourth consecutive winter of cloud-seeding along the windward side of the Continental Divide.

The project area is huge — 1,600 square miles — and is larger than the State of Rhode Island. At this site scientists are pursuing a very serious objective. They are concerned with winter storms that provide the lifeblood of all western streams and rivers. A river's flow is governed by the amount and character of snowpack which, in turn, is produced by



Secretary Morton has visited with many Indian tribes since becoming head of the Department of the Interior in January 1971. He is shown (Top) at a welcoming ceremony with leaders and other members of the Taos Pueblo Indian Tribe in New Mexico. (Bottom) The late William T. Pecora, Under Secretary of the Interior, from May 1971 to July 1972.

uncertain and infrequent storms moving through the Rockies.

Scientists there have found no way of influencing the frequency of snowstorms, nor can they influence precipitation from *all* kinds of atmospheric circumstances. But they are learning how to improve the precipitation production of *certain* kinds of clouds. That discovery, along with other knowledge gained from the cloud-seeding program, could become an important advance in augmenting water for the Upper Colorado River Basin.

The brief descriptions given here will only serve to acquaint you with the broad diversity of Interior's complex responsibilities. Chapters that follow give details of many efforts and accomplishments — by both employees and people outside the Department.

As guardian of America's natural resources, we must be alert to all the vicissitudes that affect our land and water, fish and wildlife, minerals and fuels, and human resources.

In bringing these highlights of Interior actions, I recall the contributions of Dr. William T. Pecora, a widely acclaimed expert in mineralogy, petrology, and geochemistry, who was

Under Secretary of the Interior from May 1971 until his death July 18, 1972. A distinguished career scientist, he began his career with the Geological Survey in 1939 and served as Director of the Survey from 1965 until he became Under Secretary.

Dr. Pecora was an astute person who moved effectively in learned scientific circles and received many honors for distinguished and continuing achievements in original research from the Department of the Interior and outside organizations. He was an able, genial realist and often gave expert scientific and philosophical advice.

At the University of California in January 1972, he said: "To one who has spent his professional career in geologic science, conservation always has had special meaning. In the measurements so necessary to his work the geologist develops an integrity in the use of numbers.

"Scientific analysis of geologic events and sequence develops a keen sense of what is coincidental, correlative and consequential. The geologist applies his science in evaluating hazards to man as natural catastrophes and/or benefits to man such as earth materials that form the resource base of his society. But more than these the geologist has acquired a deep appreciation for the planet as a whole, its inner structure, its landscape, and the living things that abound."

Few men possess the leadership qualities Dr. Pecora showed in the quest for balance and harmony in resource development and conservation.

He understood conservation in the true sense. As a scientist, he recognized that nature's forces are neither angry nor benign; they operate on laws and principles of matter, motion, physics, and chemistry. He felt strongly that man must not seek to subdue these forces, but should understand them, and work and live in harmony with them.

An able, genial optimist, he expressed his scientific philosophy in these words:

"One must look at the role of man on this earth. If he is to survive as a species, and a thriving species, he does, in fact, need more resources. But, on the other hand, he must adopt good housekeeping.

"Therefore, all of his attention must be not only to the science and technology for seeking and developing earth's resources, but at the same time maintaining a careful balance with the environment so that his trade-offs and judgment values do not destroy the very environment upon which he calls for his subsistence."

In line with Dr. Pecora's sound advice, I propose that we firmly resolve to:

Protect the environment for present and succeeding generations.

Make wise and beneficial use of the environment without degradation or risk to health and safety.

Preserve and protect the historic, cultural, and natural aspects of our national heritage.

Enhance the quality of our renewable resources.

Recycle our depletable resources.

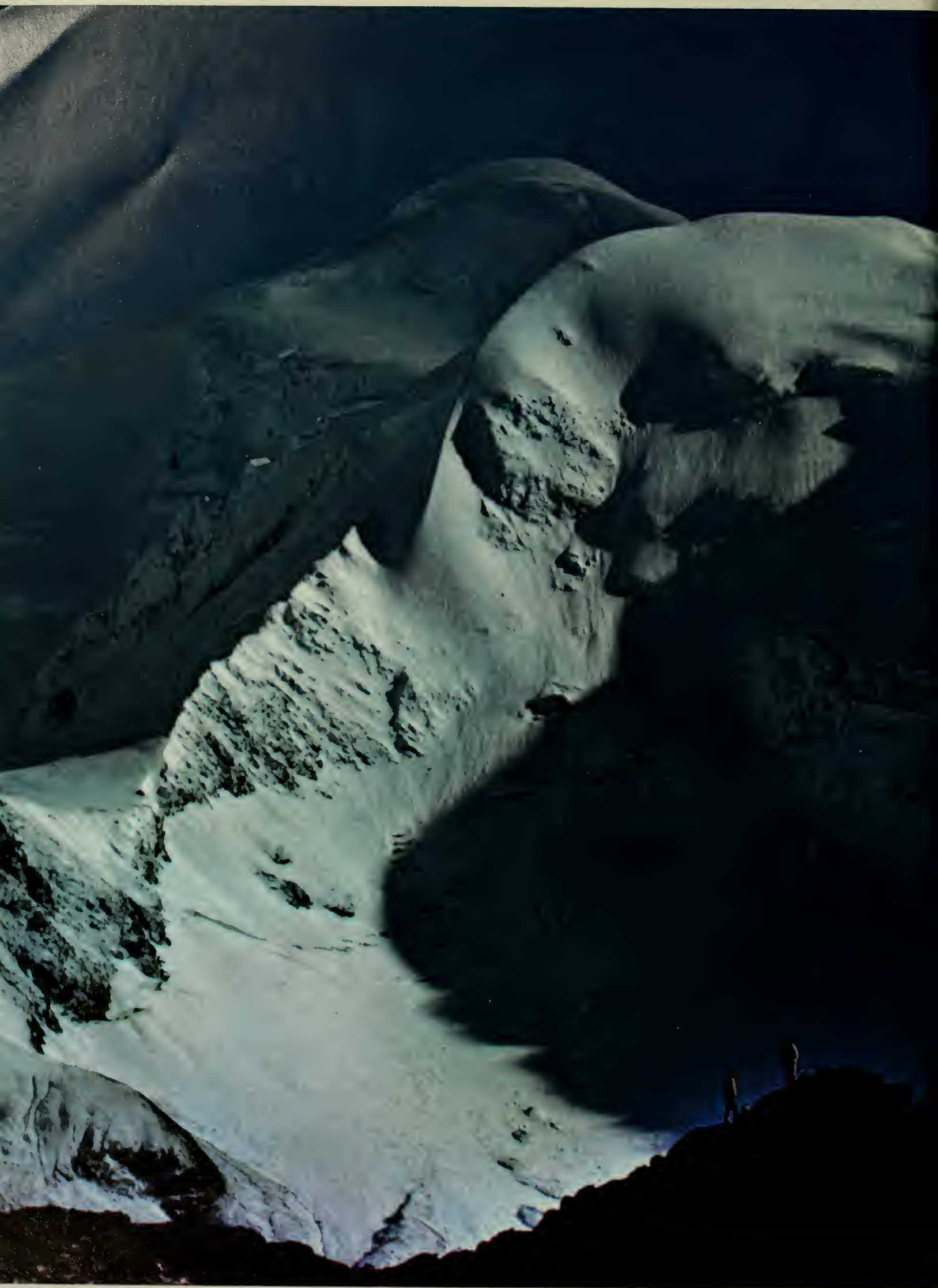
Seek a balance between population and resource use to assure Americans a high standard of living.

Those precepts constitute an environmental ethic that can protect and enhance America's great heritage.

Roger C.B. Morton

Secretary of the Interior

I AMERICA OUTDOORS



Moving People in Parks

Park your car. Use the bus. Ride a bike. Hire a horse. Or hike.

These are signs of the Seventies in a growing number of areas in the National Park System.

They tell the park visitor that the National Park Service (NPS) is in touch with the people's 1973-74 transportation needs in the 298 areas of the System which NPS administers for the Department of the Interior.

The Service was very much in touch with Mr. and Mrs. Harris Cassagne of Reserve, Louisiana, in September 1972 through a Tourmobile service operated by an NPS concessioner.

The young couple was visiting Washington, D.C. They were eager to see the many parks, monuments and memorials administered by NPS in the city and nearby Maryland and Virginia.

"However," Mrs. Cassagne recalled later, "we found driving extremely difficult, not knowing exactly how to get to each park and where to park. We used Tourmobile service for three days and were extremely well pleased. On a family budget it is truly the best way to see Washington."

In 1972 Tourmobile and similar services in three other NPS areas carried 4.7 million passengers. About 98 percent of these were carried in the National Capital Parks and in Yosemite National Park, Calif. Everglades National Park, Florida, and Mt. McKinley National Park, Alaska, accounted for the other 2 percent.

A new tram service on the 14-mile Shark River loop road in Everglades began operating March 4, 1972 and carried 52,000 passengers in the next 12 months. At Mt. McKinley, NPS began a concessioner-operated, free bus service in 1972 over the 170-mile, round-trip, park road. This service carried some 30,000 passengers. The concessioner also operates a similar service as part of a tour package. It carried 3,000 people over approximately the same route for \$15 each.

In 1973, NPS started free bus transportation in Mesa Verde National Park, Colorado, and Lyndon B. Johnson National Historic Site, Texas. The Service also cited 17 other NPS areas "where the need for alternatives to private automobile access may exist."



(Left) Portion of Alaska Range as seen from Anderson Pass in Mt. McKinley National Park. (Top) Doubledecker buses provide free service in Yosemite National Park, California. One such 100-passenger bus at capacity use replaces 28 cars and uses propane gas to reduce pollution. (Bottom) An 87-passenger Tourmobile brings sightseers into this spring scene in Washington, D.C. parks. At capacity use National Park Service concession vehicle replaces 24 cars.



These are:

Sequoia-Kings Canyon National Parks and Golden Gate National Recreation Area, Calif.; Grand Canyon National Park, Ariz.; Rocky Mountain National Park, Colo.; Fire Island National Seashore, New York; Gateway National Recreation Area, New York-New Jersey; Fort Sumter National Monument, S.C.; Glacier National Park, Mont.; Grand Teton National Park, Wyo.; Guadalupe Mountains National Park, Tex.; Hot Springs National Park, Arkansas; Guilford Courthouse National Military Park, N.C.; Mount Rushmore National Memorial, S.D.; North Cascades National Park, Wash.; Yellowstone National Park, Wyo.-Mont.-Ida.; and Colonial National Historical Park, Virginia.

Why is NPS putting the brakes on automobile use in these parks? Mass transportation is simply better for the park, for the visitor, for the park employee, for the environment, for society, and for the pocketbook — both the visitor's pocketbook and Uncle Sam's.

Since these advantages involve the environment, enjoyment, efficiency and economy, they may be summarized as the "Four E" benefits of mass transportation:

1. Environment — Buses reduce air pollution 80 percent, traffic and noise pollution 85 percent, aesthetic pollution 85 percent. (Aesthetic pollution is 15 cars bumper-to-bumper blocking a park road.) One bus replaces 15 cars. Propane conversion of Yosemite and Everglades vehicles further cuts air pollution to less than 10 percent that of cars. Diesel engines would reduce pollution almost as much as propane.

The park wildlife and plant environment also benefit from traffic reduction. Since buses replaced cars at Mt. McKinley National Park and on the Shark Valley Loop Road in Everglades, wildlife has returned to the roadsides. Soil impaction by cars at Mariposa Grove in Yosemite was a contributing reason for eliminating automobiles there. Trams are not parked as automobiles were, impacting the soil and interfering with the growth of young sequoias and the shallow root structure of old sequoias. It is also easier to locate comfort stations, picnic areas and other facilities if they are served by bus.

2. Enjoyment — Visitors appreciate the opportunity to give up their cars for buses in Yosemite Valley and National Capital Parks (NCP). They can enjoy

the scenery without worrying about gasoline, maintenance and where to drive and park. Visitors also enjoy wildlife more by bus because there are fewer vehicles to disrupt the wildlife environment. Trained guides and drivers add to visitor enjoyment with skilled interpretation.

Buses allow even the driver of the family car to enjoy the parks. Confidence in safety and security replaces traffic concern. (Tourmobiles in National Capital Parks carried some 2.9 million passengers from early 1969 to July 1, 1973.) Open or glass-walled vehicles give visitors spacious observation and photographic opportunities. Entering or leaving the transit system almost at will all day at no extra charge is an especially popular privilege.

3. Efficiency — At a time when energy resources are dwindling, it takes only one-sixth as much energy to transport a bus passenger as to move an automobile passenger. A bus is a more efficient people-mover because it can deposit a passenger almost anywhere — at the entrance of a large parking lot, for example. The car driver cannot do this; he must place his car in the parking lot and walk to the entrance. The bus thus saves the expenditure of time and energy necessary to park and walk. It eliminates the car as the visitor's fixed operating base to which the driver might return several times a day.

Mass transit park vehicles are *designed* for efficient people-moving and park-viewing. Automobiles are not. The more efficient transit vehicles are equipped with spacious observation features, safety devices and other facilities. Bus systems relieve park management of building comfort stations and picnic facilities every few miles for car-borne visitors. To avoid placing such facilities along Mt. McKinley's park road, NPS is recommending the purchase of large new buses with restrooms.

An unexpected dividend of mass transit in the parks is "social mix." Park managers say buses are the best way to bring all types of park visitors together. The buses act as common denominators. They generally promote an harmonious social atmosphere and remove the isolation barriers that often surround many groups in cars. Buses make meeting people a rewarding element of the total park experience.

4. Economy — Buses are more economical, both to park visitor and park management. Of the four NPS

areas with mass transit in 1972, three charged no fares. The two areas opening bus routes in 1973 also provide free service. The Tourmobile service in National Capital Parks is \$2 per person for all day on the Mall route and \$1.25 on the Arlington National Cemetery route.

The economy to NPS is less direct but it is real. The number of parking lots is greatly reduced. NPS also realizes savings in manpower, maintenance and training costs and in traffic management, law enforcement and road upkeep.

Environmental savings may be the greatest dividend and can scarcely be expressed in monetary terms. An indication of such benefits is the fact that many park rangers who formerly were bogged down in traffic patrols and traffic tickets now are able to prepare campfire talks and advise campers about bears, boating, fishing, alligators, moose and bald eagles.

NPS transportation resources include boat, air, bicycle and horse facilities. Generally, this equipment is supplied by concessioners.

The increasing demand of Americans for water recreation has added scores of aquatic recreation resources to the National Park System. To manage these areas NPS has a "fleet" of boats plying waters from Glacier Bay National Monument, Alaska to Virgin Islands National Park in the Caribbean.

Boats are the only practical method of visiting such areas as Statue of Liberty National Monument, N.Y.-N.J.; Fort Jefferson National Monument, Florida; and Fort Sumter National Monument, S.C. In Everglades National Park, where one of every five visitors enters by boat, water craft are as necessary as patrol cars.

The National Park Service has 1,900 miles of sea front and Gulf front property and about 500 miles fronting on the Great Lakes. Though less than 3 percent of the country's coastline, this waterfront requires much aquatic transportation. Also in the System are 552 miles of riverfront in three national scenic riverways and Buffalo National River, Ark., plus hundreds of miles of riverfront along the Mississippi, James, Colorado, Green (Colo.-Utah), Green (Ky.), Yampa, Big Bend, Merced, and dozens of other rivers, bays, sloughs and inlets.

Thus, boat transportation is a major element in visitor enjoyment. Twenty-six areas provide boating transportation through concessioners. Among areas

where boats are essential for management, visitor use, or both, are Acadia, Isle Royale, Grand Canyon, Virgin Islands, Big Bend and Redwood National Parks; Fort Matanzas National Monument, Florida; San Juan Island National Historical Park, Wash.; Channel Islands National Monument, Calif.; Buck Island National Monument, Virgin Islands; Biscayne National Monument, Florida; Roosevelt Campobello International Park, N.B., Canada; nine national seashores; four national lakeshores and 14 national recreation areas.

Air flights are provided in Isle Royale National Park; Glacier Bay and Katmai national monuments; Lake Mead National Recreation Area, Nev.-Ariz.; and Wright Brothers National Memorial, N.C.

Bicycle rentals are available in National Capital Parks, Everglades National Park and Yosemite National Park. Forty-eight NPS areas contain bicycle routes listed in the American Youth Hostels' North American Bicycle Atlas. Special bicycle paths and programs are in operation in NCP, Cape Cod and Yosemite. NCP rental outlets include three for bicycles, two for saddle horses and four for boats.

Horse-drawn vehicles ply 70 miles of carriage trails in Acadia and in Glacier National Park, Mont., Blue Ridge Parkway, Va.-N.C., and Theodore Roosevelt Memorial Park, N.D. Horseback riders and pack trains have more than 7,000 miles of trails for use in the National Park System.

NPS is providing public transportation by three methods: By completely subsidizing concession operations; by granting concession permits to provide access to the parks; by NPS-owned and NPS-operated systems. A fourth method will allow contract operation of NPS-owned vehicles.

Future NPS transportation policy calls for (1) Increased public transit access to the parks through cooperation with State, regional and local programs; (2) Coordination with other Federal transportation programs through the Department of Transportation; (3) Reducing the energy needed for park transportation; (4) Private investment in transit programs; and (5) Replacing highway and parking expansion with public transit programs.

National Capital Parks

A visitor shuttle service was recommended to NPS in 1965 by Thomas G. McCaskey, of Colonial Williamsburg, Inc. The Mall improvement plan, proposed to NPS by the architectural

firm of Skidmore, Owings and Merrill in 1966, also recommended a shuttle service.

A six-weeks experimental Mall shuttle in the fall of 1966 met a highly favorable response, and NPS awarded a 10-year contract for such a service, to begin May 1, 1967. The shuttle could not start, however, because of a suit challenging the Department's contract authority. The Supreme Court found in favor of the Department, and service started March 17, 1969.

In its first four years the Mall shuttle carried 1,314,454 fares, including 400,454 in 1972.

The \$50,000, open-air, 88-passenger Tourmobiles are low-slung and easy to board or leave. They have side windows for bad weather. The \$2 fare is valid all day for unlimited boardings and departures. (Children's fare is \$1.)

A similar 2.4-mile shuttle in Arlington National Cemetery began on December 14, 1970 at \$1.25 per adult. Three 77-passenger and 14 88-passenger Tourmobiles now operate on the Mall and five 125-capacity Tourmobiles on the Arlington route. Mall shuttles run every 5 minutes from 9 a.m. to 7 p.m. between June 15 and Labor Day, and the rest of the year from 9:30 a.m. to 5 p.m. The 125-passenger Arlington shuttle carried 632,426 fares in 1972 for a total of 1,146,426 since 1969.

The Mall tours start at the Washington Monument. Boarding points are identified by blue-and-white Tourmobile signs. The Mall shuttle stops at the Smithsonian Institution, the Grant Memorial west of the Capitol, the Museum of Natural History, the Jefferson and Lincoln Memorials, and the Ellipse behind the White House.

Trained narrators describe the historical, political, architectural, cultural, and contemporary significance of these national heritage landmarks. Many other points of interest are within walking distance of each stop.

Lyndon B. Johnson National Historic Site, Texas

Five buses with sightseeing units are being introduced here in 1973-74. They replace eight conventional buses operating on an interim basis. With the advent of vehicles the trip along the Pedernales River becomes a comfortable tour with enlightening narration by trained interpreters.

Grand Canyon National Park, Arizona

Private vehicles eventually will be eliminated from the park's Grand Canyon Village and West Rim Drive routes. A public transit system is



(Top) Float planes bring visitors to Glacier Bay National Monument in Alaska. (Middle) Ranger III at Isle Royale National Park, Michigan, provides transportation from mainland. (Bottom) Trail horses bring visitors to camp at High Lake in Yellowstone National Park.



scheduled to open in the spring of 1974 with six multi-unit vehicles over a village shuttle run. A West Rim tour concession contract will delay opening of NPS transit there until the summer of 1974.

Mount Rushmore National Memorial, South Dakota

This park attracted a record 2.3 million visits in 1972 and has been designated an American Revolution Bicentennial area. To prepare for even heavier visitor use, NPS is considering construction of remote parking facilities and would furnish buses to take there carloads to the Memorial. Present parking facilities have reached capacity level.

Gateway National Recreation Area, New York, New Jersey

The newly authorized aquatic resource area is dependent on a coordinated transit system of buses, subways, surface rapid transit, and water-borne systems.

Yosemite National Park, California

Electric buses brought silent spring transportation to Yosemite National Park on an experimental basis in 1973. The buses operated on a regular schedule on the Yosemite Valley free shuttle routes from April 18 to 22.

Seven manufacturers demonstrated vehicles in response to an invitation from the National Park Service to the Pacific Coast Electrical Association. Electric trucks and personnel and equipment carriers were also demonstrated.

The trail period showed that the electric vehicles are quieter and cleaner than those now powered by propane gas, liquid natural gas, diesel fuel and gasoline. The electric vehicles also operated efficiently.

Park officials say that the low-cost power at the Park's own hydroelectric plant on the Merced River offers another advantage for electric vehicles. Recharging them is a simple operation.

Other Plans

Although plans are still in the formative stage, visitors to many areas of the National Park System in the future may be riding a tramway up Ruby Mountain in North Cascades National Park, Washington; an expanded ferry service to Fire Island National Seashore, New York; added buses in Mesa Verde National Park, Colorado; bus tours in Glacier National Park, Montana, and a coordinated system of fast public transit at Golden Gate National Recreation Area, California.

Spaces and Places

For a 10-year-old boy, a scant three acres are stretched and widened by youthful imagination and imagery.

In his mind's eye, the saga of a summer is slowly lifted, giving way to a wintry, wind-lashed tableau of survival. An unfolding drama of a courageous crew manning an ice-caked Great Lakes freighter is suddenly spotlighted for the young spectator by the piercing beam of a Lake Erie lighthouse.

Across a continent, an elderly man near Malibu lifts his eyes to the Pacific.

Shapes and silhouettes merge into a curious contradiction of lumbering grace as the man's seasonal pilgrimage is rewarded.

He is whale-watching.

Linking man and boy is a growing network of spaces and places in America's ever-expanding Legacy of Parks program.

A mere three acres within eye-shot of the Marblehead Lighthouse on Ohio's lakeshore give room for the youngster's fantasy to roam. In an earlier day he might have witnessed the Great Lakes naval battle etched in history with the words of young Naval Officer Oliver Hazard Perry: "We have met the enemy and they are ours!"

The perching point for the whale-watching man is the one-time Point Dume Instrumentation Station—a 1.31 acre site on a stretch of Southern California's coast better known for its attractiveness to girl-watchers than for devotees of the determined California Gray Whales.

Both patches of retreat are pieces of an outdoor mosaic showing surplus Federal lands and waters being converted to public parks and areas of outdoor respite.

Since the start of the program in March of 1971, other parcels have been announced for no-cost conveyance in all 50 States, the District of Columbia, and Puerto Rico.

In only the first two years of President Nixon's Legacy of Parks concept, Federal lands surplus to Federal needs have been deeded for some 325 parks, increasing parklands acreage by over 50 thousand acres, and representing an estate estimated at about \$150 million.

In the expanding Legacy of Parks

program, conveyance of Federal surplus property represents a growing reinvestment in recreation lands and waters.

Other facets of the program include funding infusions through the Land and Water Conservation Fund, "Reclamation for Recreation" of surface mined lands, and recreational considerations along flood plain areas.

The program received a sort of first family seal of approval quite early when Mrs. Nixon toured and conveyed eight parcels in Michigan, Minnesota, Oregon and California.

In the three-day swing starting August 16, 1971, the First Lady saw deeds go to:

Michigan—24 acres at 40-Mile Point Light Station awarded to Presque Isle County; a one-acre postal facility at Rogers City (total estimated fair market value, \$45,900); and almost 3,000 acres at Fort Custer (\$860,000);

Minnesota—141 acres at Fort Snelling (\$3,100,000);

Oregon—421 acres of Camp White to Jackson County; four acres at Camp Adair to Benton County; and two acres of a Naval Reserve training center to the City of Roseburg (\$167,800); and

California—372 acres of Border Field, San Diego, to the State (\$3,750,000).

The size and character of each conveyance differs.

A former post office and customs house on one acre of land in Evansville, Indiana, is slated to be a community center. Five acres at a former seaplane ramp and turnabout were deeded to the State of Alaska for water-oriented outdoor activities. And 316 acres at Fort Robinson were conveyed to Nebraska at what once was a beef cattle research station.

In the nomenclature of Federal property, a "Gap Filler" is not an instrument of orthodontics. Rather, it is a small-scale sky-tracking support station, positioned to cover areas between larger stations.

Unused Gap Filler sites offer mini-park potential and average about two acres. As can be imagined, their good roads provide access to adjacent State or community-owned parks. In other cases, the block buildings and tracking towers are readily convertible into community centers, observation towers and scenic overlooks.

It is no happenstance that many of the surplus tracts are in or near population centers. The City of Seattle was deeded 391 acres from a portion

Even the smallest of surplus military installations offer rewarding recreation opportunities for nearby cities and counties. Towers, access roads, and buildings offer residents many chances for outdoor purposes. (Right) Point Dume, California; (Middle) Marblehead Lighthouse in Ohio; (Bottom) an eastern tracking installation.



of Fort Lawton. Its outdoor potential is further enhanced by the spectacular view of Puget Sound.

Other plots provided precious green space for such metropolises as Los Angeles, New Orleans, San Diego, Madison, Wisc., Boston, Topeka, San Antonio, Orlando, Phoenix, Anchorage, St. Louis, San Francisco, Miami, Memphis, North Little Rock, Fort Worth, and Nassau County, N.Y.

To those of the Bureau of Outdoor Recreation and the General Services Administration who team in administering the surplus lands program, one compelling aspect is a variation of the "swords into plowshares" theme.

Phased-out NIKE, Atlas, BOMARC and other one-time missile sites will be converted to park and recreation uses near populated areas, including: South Plainfield, N.J., Greater San Francisco, Monmouth County and Holmdel, N.J., San Rafael, Redondo Beach, and Los Angeles, Calif. Thousands of people will enjoy those areas every day of the year when weather and other factors permit.





Refuges for Wildlife and People



National wildlife refuges are for people and wildlife: The honkings of wild geese replace the din of city traffic; young students visit Blackwater National Wildlife Refuge; visitors leave their cars to learn more about wildlife at Blackwater; students show fascination at wildlife display; banding is an important function of wildlife management.

National wildlife refuges are lands for people as well as wildlife.

Blackwater National Wildlife Refuge, located on Maryland's Eastern Shore, less than two hours from the Washington-Baltimore metropolitan area, is one of the more people-oriented of the Fish and Wildlife Service's 340 refuges. The 11,627-acre area offers refreshing relief from the city's atmosphere. Fields, woods, and marshes replace asphalt, concrete, and steel, and the honkings of wild geese replace the din of city traffic.

Hundreds of persons visit the refuge on fall weekends when migratory waterfowl are at peak abundance. Seasonal change of habitat and wildlife make the refuge inviting during all seasons.

Newcomers seek information at the visitor center, where exhibits indicate the wildlife species common to the refuge. Films and slide programs often are shown to provide further familiarization.

By arriving at the right moment, one can watch a live wildlife performance through large windows at the rear of the center. Geese come in by the hundreds from feeding flights to nearby fields. With incessant honking, they tumble out of the sky, spilling the air from their wings and gracefully gliding down upon the water of the impoundment constructed for them.

From the center, visitors are directed to the wildlife drive which passes through woods and fields, diked ponds and marshes. Great blue herons stalk the shallow waters, and deer graze at the far reaches of a bordering field, ready to flee into the woods at the first sight of danger. In warmer months, turtles lazily sun themselves on fallen logs and egrets and shore birds wade along the water's edge.

A picnic area and observation tower are located off a side road near the entrance to the wildlife drive. The tower, an old converted fire tower, overlooks a vast area of river and marsh and offers a good panorama of

the refuge. The structure also is a suitable place from which to glimpse the endangered Southern bald eagle which uses the small tree islands and wooded edges of the marsh as nesting and roosting sites. Sunlight glances off his bold white head as he soars high above the river, then swoops to catch a fish in the dark waters.

A trail for walkers winds through a mixed pine-hardwood forest, managed habitat of the endangered Delmarva Peninsula fox squirrel, or "big gray" as he is called locally. Deer, songbirds, and the common gray squirrel also are present.

One can wander peacefully through these woods in spring—rays of sunlight splashing on the forest floor, and chickadees and warblers chattering and twittering as they hop from branch to branch in search of insects. Occasionally a pileated woodpecker or yellow-billed cuckoo voices its distinctive call, or a crow shouts warning of an approaching visitor.

School classes take advantage of Blackwater, too, where students see history as well as ecology before them. Furrows on the wooded land indicate former farm fields, remains of an old steam-powered sawmill tell of lumbering days, and, in spring, way off from the trail, daffodils bloom where an old homesite once stood.

Youngsters occasionally are permitted to participate in the refuge's waterfowl banding operation. Eyes light up as hesitant young hands reach for the first duck they've ever held.

So popular has the area become for teachers that the small refuge staff now is overtaxed. To try to solve this problem, personnel have encouraged teacher workshops and orientation sessions to acquaint instructors with the area and with ways they can use the refuge on their own as an environmental study area.

Adults also like to be involved with Blackwater's wildlife, and activities are scheduled for them. An annual wildlife photography contest and exhibit, for example, stimulates interest and demonstrates the artistic and aesthetic value of wild things.

Limited fishing and deer hunting provide recreation for the active sportsman, consistent with the refuge's primary purpose. Thus there is some kind of wildlife-oriented recreation for nearly everyone.

Blackwater is an excellent example of how wildlife and man can exist in harmony, and to the benefit of each.

Filling the Recreation Spectrum



"I wasn't doing much of anything. I wasn't exactly going anywhere," said Mike, thinking back to directionless, dropout days three years ago. "But Mr. Cook got me interested in recreation and sports. He got me a job in the summer, and I enjoyed working with kids. So I decided that's what I wanted to do."

To do it, Mike was encouraged by Cook to work for a high school equivalency diploma. Mike today is a paid recreation leader.

Mr. Cook met Mike in Atlanta's Grant Park, an emerald patch within the shadows of Atlanta's shimmering skyscrapers. Cook is a community center and recreation director in Atlanta's racially-mixed inner city.

Cook's success story with Mike is only a slight switch from similar cases which give pride to park people across the Nation. The one little difference? Hugh Cook who gave the helping hand



States and communities have enlarged their outdoor recreation heritage through assistance from the Land and Water Conservation Fund. (Top) Mike Turner and Hugh Cook are shown at Atlanta's Grant Park—a facility that now has a swimming pool through Fund assistance; (Middle) Massachusetts acquired 13 islands, one of which is shown, in historic Boston harbor; (Bottom) a litter-filled alleyway in Baltimore was converted into a mini park.



is black. Mike Turner, the neighborhood youngster, is white.

Cook says his park programs are aimed at reaching the kids while there is still time. "But we get 'em at every step. A lot we get before they get into trouble; some on their way into trouble, and others . . . well. . . ."

Park Director Cook is close to his kids. And they remain close to Cook, and to Grant Park.

The Park's newest attraction for Atlanta youngsters is a swimming complex that will boast a 50-meter Olympic competition pool, diving pool, training pool, and bathhouse. This new outdoor facility will handle up to 1,000 people at a time.

The complex was assisted by a Federal grant of \$254,851 from the Land and Water Conservation Fund, administered by the Interior Department's Bureau of Outdoor Recreation. A matching amount came from the City of Atlanta and from Model Cities funds.

The Atlanta swimming pool is one of scores of urban green spaces and facilities being acquired and developed with assistance from the Land and Water Conservation Fund (L&WCF).

The Fund has helped infuse millions of dollars into planning, acquisition and development for States, counties, and communities.

In a typical year, about 40 percent of the Fund's appropriation is invested in acquiring new Federal recreation lands and waters: such recreation resources as national parks, seashores, lakeshores, forests, wild and scenic rivers, trails, national recreation areas, and natural and wilderness areas.

The remaining 60 percent provides grants to States and through the States to their political subdivisions. This grant money is matched dollar for dollar by the State or local governments and is used for acquisition and development of public outdoor recreation areas and facilities. Today, roughly half of the Land and Water Conservation Fund grants are aimed at assisting cities.

An overall national balance of L&WCF assistance is attained since the States set their own priorities that are guided by those urban and non-urban characteristics within the States.

So, while large-city grants offer high visibility, the Fund is equally viable in such areas as preserving wilderness, providing areas for wildlife habitat, and expanding recreation roles for non-urban areas.

One recent L&WCF grant reflects

both innovation and cooperation — a rooftop recreation complex atop a pollution control plant.

In announcing the initial grant of \$3 million, Secretary Morton hailed the concept, saying:

"This inner-city New York project is perhaps the most dramatic and imaginative utilization to date of President Nixon's 'Legacy of Parks' program, which is bringing top quality recreation to urban America."

Located on the Hudson River side of Manhattan's Harlem section, the recreation area will cover some 30 acres of the roof on the North River Water Pollution Control Plant now under construction.

The multi-purpose rooftop recreation site, when completed over a ten-year period, will feature a picnic area, a general-purpose playfield, a swimming pool, three multi-purpose courts, wading and diving pools, an open-air artificial ice rink, landscaping, fencing, access roads — even a trail!

In the March 1973 grant notification, Secretary Morton noted: "Nowhere is land more scarce or more highly-priced than within our great urban areas. Recreation for the inner-city will probably need to be tied more and more to multiple use, such as we have in this New York project.

"The hard dollar cost of creating the 30-acre recreation space in this section of Manhattan compared favorably with the expense that would be required to actually acquire land, demolish the structures on it, and relocate families and business. This does not include the enormous social costs — the vital human factors — involved in the movement of people and their businesses."

A sharper focus upon urban recreation is encouraged by Interior as the States prepare their Statewide Comprehensive Outdoor Recreation Plans (SCORP). Such plans are prerequisites to Bureau of Outdoor Recreation approval and Land and Water Conservation Fund monies.

Project and acquisition needs cover the full spectrum, as do the funding approvals which assist States in satisfying demands. Where Miami, Florida, wanted (and received) a community park, Miami, Ohio, wanted (and received) a facility for swimming.

L&WCF support assisted Philadelphia for a bike path in Fairmount Park, dedicated as a National Recreation Trail.

Inner-city residents of Memphis are

within easy walking distance of the Memphis Riverfront Project — with its trails and picnic tables commanding a spectacular view of the Mississippi River.

In one corner of Memorial Park in Colorado Springs is a recreation area with playground equipment, ramps, restrooms, and other accommodations designed for the handicapped. Features include sidewalks and ramps for lakeside fishing and a flush-to-the-ground merry-go-round.

A public small craft harbor on the Gulf of Mexico for people around Biloxi received L&WCF support.

A former alleyway in Baltimore is now an inner-city playground and tot lot.

In or near urban areas are fishing piers or river access facilities. The city of Flagstaff now boasts a public, artificial ice skating rink. Further south in Arizona, Scottsdale has an urban campground.

After tropical storm Agnes raged through Pennsylvania's Wyoming Valley, the Fund provided assistance to the Wilkes-Barre area in more than a dozen city and State park restoration projects.

In historic Boston Harbor, assistance was furnished to Massachusetts to acquire 13 islands.

Development money on a precious stretch of public beach was provided for the people of San Juan, Puerto Rico — alongside the luxurious Caribe Hilton Hotel.

In some cities, new tennis courts were assisted by L&WCF support, in others, space for frisbees and frolicking, or, perhaps, a needed comfort station.

Nature centers, trails for the handicapped, scenic overlooks, inner-city access sites to a river, or just plain old room-to-roam areas have received assistance from the Fund.

From the start of the program on January 1, 1965, the number of State grants through June 30, 1973, totaled 10,850, and represented Federal assistance in excess of \$503,250,000.

However necessary, the real pivotal point of the Land and Water Conservation Fund program is not money, acres, or park hardware. Rather, it is people.

In the case of an inner city swimming pool, a poignant point was made by comedian Bill Cosby. Reminiscing about his youthful summers in the city, he said:

"It's hard to learn to swim . . . real good . . . under a fireplug."

Saving Backcountry Trails

Secretary of the Interior Rogers C.B. Morton made the first announcement early in 1972 — the National Parks Centennial Year.

Backpacking and camping in remote areas of some national parks, he said, had become so popular that the sheer volume of these rugged climbers and hikers was endangering the fragile alpine meadows and high timber areas they had come to see and enjoy.

Take the Appalachian Trail — and literally thousands do, each summer, where it crosses Great Smoky Mountains National Park in North Carolina and Tennessee. What happens when a hundred or more hikers converge at evening upon a shelter meant to accommodate eight or 12 persons? Fresh water and sanitation facilities are obviously overtaxed. The wilderness experience they sought evaporates into a supermarket parking lot with wall-to-wall bedrolls.

For the sake of preserving both the wilderness, and the wilderness experience for back-country hikers, Secretary Morton instituted a rationing system beginning at Sequoia-Kings Canyon National Parks in California's high Sierra country, Rocky Mountain National Park in Colorado, and at Great Smoky Mountains.

All persons hiking the trails would have to obtain a permit from the park headquarters or at a ranger station. Permits would be issued on a first-come-first-served basis up to 24 hours before the hike. Once the capacity of the trail was reached for the day no more permits would be issued.

Even though one trail might be closed, most hikers would find alternate routes immediately available. Indeed, one of the program's objectives is to disperse park users over a greater area of the parks.

"While some may be disappointed at not being able to visit a favorite backcountry area, I am confident that the prospect of retaining these areas

in their natural condition, untrammelled and unspoiled, is more than adequate compensation for temporary inconvenience," Morton said.

Some hikers applauded. Others did not. But almost all agreed it was absolutely necessary.

Said hiker Don Deck of El Cajon, Calif., who has logged more than 4,000 miles along High Sierra trails, "I don't like the idea of controls from the standpoint of personal freedom, but I sure recognize that with the volume of people now on the trails something had to be done.

"I guess it's just like a sports stadium. It has only so many seats. When it's full they stop selling tickets," he said.

When Deck first started hiking the Sierras in 1957 "we would see maybe two or three people all day — sometimes nobody — yet last summer a friend of mine counted 800 people in one day either on the trail or camped along the way."

Park officials confirmed Deck's observations, pointing out that the use of the Sequoia-Kings Canyon backcountry increased between 1962 and 1971 from 57,000 to 207,000 visitor days and that the wilderness was suffering an obvious decline in quality as a result.

In its first season, the trail limitation program worked well at Sequoia-Kings Canyon. Group hikers, such as Boy Scouts and church youth groups voluntarily split up into smaller units. Many groups rewrote their instruction booklets to stress the use of lesser traveled trails and to support tightened regulations on campsite locations, fuel gathering and waste disposal.

Those hiking along the Rae Lake loop trail — the area where restrictions are in effect — almost unanimously reported a return to the quiet and calm of the wilderness, the experience that they had come to find.

Across the continent, the trail limitation system was applied to the Appalachian Trail in the Great Smoky Mountains. Perhaps the most famous trail in America, it is the target of hikers from all over the nation.

Many arrived at the park in the summer of 1972 prepared to hike their favorite section of the trail — from Newfound Gap to Fontana Dam, for example. Many of these people were told that the number of hikers scheduled on the trail that day had reached the capacity of the trail's overnight shelters and no more permits would be issued.

That happened to the Dave Johnson

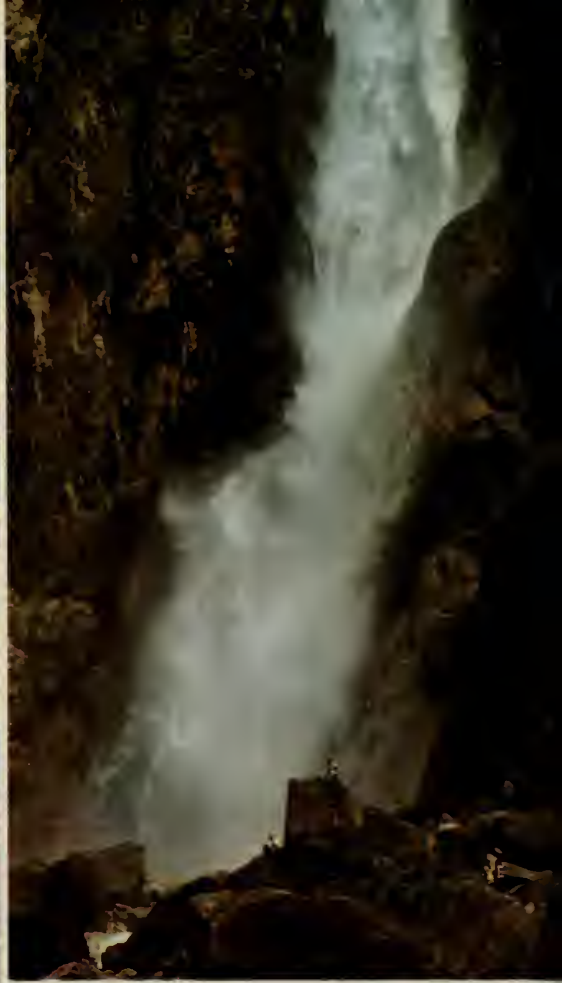
family of Detroit, Mich. "We were pretty disappointed when the girl at the visitor center said the trail was full," Mrs. Johnson said.

But the Johnsons were somewhat relieved to find that many other trails in the park were open and available for backpacking.

"We picked out another route that would take us to Fontana Dam," Johnson said, "it looked good on the map and had some pretty interesting sounding trails — Jenkins Ridge, Haw Gap and Lost Cove."

Not only did the Johnsons find the trail interesting — they found they had

Hiking in backcountry areas is rapidly increasing in popularity. (Left Top) Park Ranger Gerald Ivey checks the backcountry travel permit attached to the packframe of a hiker on the Gem Lake Trail in Rocky Mountain National Park in Colorado (Also Right Bottom). The permit is part of the new system in the park to limit backcountry trail use so that the trails survive in their natural state. Other areas that have proven attractive to backcountry visitors are located in Yosemite National Park (Right Top); Shenandoah National Park (Left Middle); and Kings Canyon National Park (Left Bottom).



it almost to themselves. "We were out three days in some of the prettiest country I have ever seen and I don't think we met more than a dozen other people. We certainly saw more animals and more wild flowers than we ever saw in the Smokies before, and this was our fourth trip here," Johnson said.

In this park, and in Rocky Mountain National Park, those directly affected by the backcountry permit program gave it solid acceptance. Those who hiked the trails found them regaining the beauty and naturalness that made traveling the backcountry a rewarding and enriching experience.

The experiences of the hikers and the rangers who operated the program were collected during the summer season and analyzed the following winter.

It was obvious that the test was a success, that it could protect and preserve the backcountry without inflicting unacceptable hardships on those who used it.

As a result, the permit system is being expanded to other endangered areas in other national parks.

This may be an unwelcome warning of the extent to which mankind's problems extend beyond the borders of "civilization," but it is also an indication of the National Park Service's determination that the beauty, the calm and the strength of the natural world shall be preserved for all Americans.

Parklands From Wastelands

A bright beautiful day in Kentucky. The streaking orange blur of a motorcyclist's helmet is the only motion on the horizon as he bumps along colorless terrain that resembles the surface of the moon.

In Oregon a child precariously picks her way along the edge of a deep hole. Below the water is polluted by acid mine drainage. Here and there patches of green prove Nature's indomitable will to make things grow.

The motorcyclist and the inquisitive child are on some of the Nation's two million acres scarred by earlier surface mining activities. Much of this

acreage is close to urban centers where outdoor recreation resources are scarce or remote. Few people can manage to eke recreation opportunities from the fractured land.

Unknown to the man on the motorcycle, the child on the rim of the man-made canyon, and others who use unreclaimed surface mined areas for recreation, their unsightly playgrounds may in the next few years become parklands worthy of the name—with clear fresh water to fish or swim in, trees, and flowers to brighten the scene, and ballfields, trails and playgrounds to enjoy. Behind the scenes, people are working on mined-land "Reclamation for Recreation."

A major impetus is Interior's program, on behalf of President Nixon's directive to overcome the environmental degradation that too often follows the extraction of minerals and fuels from our lands.

Initially a demonstration program, authorized by Secretary Morton and led by the Bureau of Outdoor Recreation, its foundations began to take shape shortly after the President's 1971 Message on the Environment. It is a program of action shared with the Bureau of Mines, other Federal agencies, State and local governments, and the private sector.

During and following a Bureau of Outdoor Recreation-Bureau of Mines inventory to identify suitable demonstration project sites, BOR Director James Watt, has invited to his office many representatives of various levels of government, conservation organizations, and mining and recreation industries.

"Through this program," he told them, "we will learn by doing. With the help of the Bureau of Mines we will determine the engineering specifics for the recycling program and learn a great deal about the costs. At the same time, we will create needed parklands at the demonstration sites. And, in the longer run, since the knowledge we gain will be made available to all, this program could eventually benefit millions of Americans."

Six months after the program was announced, 11 demonstration projects had been approved at a variety of unreclaimed surface mined areas. Together these projects encompass nearly 2,500 acres in 9 states. The scarred lands will be reclaimed and developed for recreation at a total cost of about \$5 million—half in State and local funds and half in grants from the Federal Land and Water Conservation

Fund which is administered by the Bureau of Outdoor Recreation.

One State will acquire a 600-acre, coal stripped area where coal stripping is still underway, and develop it for off-road vehicle recreation. Another has received, by donation, 1,000 acres of partially reclaimed surface mined land for a State park with trails, playfields, picnic facilities and space for all-terrain-vehicle activities.

A county will landscape a 23-acre gravel quarry, create a pond and waterfall from the pit, and provide recreation facilities ranging from trails to tennis courts. This area had a fairly typical history of abandoned surface-mined land use. For years after the mining operation ceased, it had been used as an open burning dump and for sanitary landfill. A citizen group objected to this use and pushed for its reclamation for a park.

The demonstration projects will be carefully monitored from beginning to end. The Bureau of Outdoor Recreation will develop comprehensive "case histories," including technical data and photographic records for future use.

Broad interest in reclamation for recreation was stimulated by the first National Conference on Surface Mined Lands for Recreation in Washington in May, and by similar conferences in many of the Bureau's regions, all initiated and cosponsored by the Bureau.

In response to a growing need, the Bureau established a Reclamation Information and Assistance Center in Washington, and assigned planners and resource experts in its headquarters and regional offices as reclamation-for-recreation liaison officers, to explain the effort and advise State and local officials, mine operators and civic groups of available assistance.

Interior's demonstration program will come to an end in a few years—when its demonstration areas have been converted into attractive public parklands.

But, through the attention inspired by its development, the larger reclamation for recreation program already has begun, under State, local and private auspices, with assistance through established programs in a number of Federal departments.

The real potential of the demonstration, however, will be realized as more and more surface mined areas are recycled to enhance the national environment as park and recreational grounds for people in search of the great outdoors.

For Future Generations

It's an impressive task—formulating a Nationwide Outdoor Recreation Plan—but what does it mean? It means that answers may be found to frustrations such as this:

"There has been a lot of talk about building bicycle paths in this city, but nothing has been done. There are railroad rights-of-way that are practically unused. One of them I acquired for the city.

"In the last analysis, recreation success depends upon local leadership. How to get that leadership, I can't tell you. Maybe these national men will be able to devise a means. I hope they are successful!"

This opinion and many more were expressed by private citizens brought together by a common interest in America's recreation needs.

The Department of the Interior's Bureau of Outdoor Recreation—"the national men"—went to the American people and asked them to voice their recreation concerns. The citizens were first invited to speak out at a series of ten public forums held in cities throughout the Nation during the summer of 1972. And speak out they did! Over 600 persons testified in Atlanta, Boston, Dallas, Denver, Detroit, Philadelphia, Portland, St. Louis, San Francisco, and Washington, D.C.

"What is needed is for all levels of government working with the private sector to plan, develop, and initiate outdoor recreation programs for the physically handicapped," stated a young woman, herself stricken with cerebral palsy.

"Horsemen and bicyclists and walkers are people who normally participate in their sport or their activity in small groups or by themselves, and they're not ones to organize. They need direction," an active horseman explained.

Other testimonies ranged from pleas for a 1.7-acre mini-park in inner city New York to theories about recreation management at the Federal level.

Why were the American people

expressing their concerns for recreation? This was the beginning of the voice of America in the formulation of a Nationwide Outdoor Recreation Plan, scheduled for submission to the President and the Congress in late 1973.

Through Public Law 88-29, approved in May 1963, BOR was authorized to "formulate and maintain a comprehensive Nationwide Outdoor Recreation Plan, which "shall set forth the needs and demands of the public for outdoor recreation and the current and foreseeable availability in the future of outdoor recreation resources to meet those needs."

The Bureau's nationwide planning team, under the leadership of Assistant Secretary Nathaniel P. Reed and BOR Director James Watt, realized that people are what recreation is all about—people of all kinds, ages, abilities, and recreation desires; people with varying amounts of time available for recreation enjoyment; people living under a variety of conditions—housing, types of communities, climate, and geographical location.

People are the focal point of recreation programs—the reason why recreation resources are protected and enhanced, areas set aside, and facilities and programs provided.

The plan emphasizes the triangular relationship of people, resources, and institutions, and looks at that relationship in terms of achieving the proper balance that will make possible the blend of recreation opportunities which people desire. The purpose is to form better institutions which will develop, acquire, and manage natural resources for the benefit of the people.

So people became the focus of the plan. And people provided much of the necessary input in the formulation of this comprehensive work. The concerns expressed during the ten city forums have been used, along with those comments made on the Federal agency work group reports and the rough first draft of the Nationwide Outdoor Recreation Plan.

Input from the people established several things. It became evident that there is no common denominator in voicing America's recreation concerns. It established that for every American proponent there are many opponents. There is always a minority view and seldom a majority view.

The plan has been developed as a framework for Federal development and management of outdoor recreation resources and programs

and as a guide for State and local governments and the private sector to help meet outdoor recreation needs. BOR views the plan as a means of fostering adequate outdoor opportunities for America.

This means true coordination of efforts. The nationwide planning challenge stands as a model of multi-Federal agency cooperation. Eighteen Federal agencies took part in ten work groups which explored specific areas of recreation, reported on problems with alternative solutions, and made recommendations. Naturally, each representative spoke of the missions of his respective agency, but, in a spirit of cooperation and dedication to recreation, narrow-gauged views were put aside, and work group representatives demonstrated interest only in a cause.

BOR served as the coordinator of this multi-agency effort. In the spirit of the Bureau's inception, coordination is its priority mission.

During the past year, the Bureau has been instrumental in Federal coordination through such action as the preparation of draft regulations regarding the use of off-road vehicles on lands administered by the Bureau of Land Management, Bureau of Reclamation, Bureau of Sport Fisheries and Wildlife, and National Park Service. Proposed in the draft regulations were administrative procedures for designating where off-road vehicles may or may not be permitted on national lands and conditions which must be met if off-road vehicles are to be operated in areas open to them.

The final value of the Nationwide Outdoor Recreation Plan will depend upon such coordination of efforts and cooperation of government at all levels and the private interests.

President Nixon, in his 1972 Environmental Message, emphasized that there are no local or State boundaries to the problems of managing our natural resources. The Federal Government has in the past and will continue to play an active, positive role by setting standards, exercising leadership, providing funding support, and encouraging others to help with the job. But State and local governments and the private sector must play the *central* role.

Together, governments and citizens have recognized and voiced these concerns. Together, they have formulated a Nationwide Outdoor Recreation Plan—a strategy for providing outdoor recreation opportunities to America.

"Brush Cops" Do Their Job

The public is likely to call them Federal game wardens. Law violators have called them "brush cops." By whatever title, it is clear that Uncle Sam's game management agents of the Fish and Wildlife Service are playing an increasingly important role in a society tuned to environmental concern.

Until a few years ago, if you did not hunt or fish, you probably knew almost nothing about game management agents. Then the poisonings and shootings of hundreds of bald and golden eagles became national news in 1971 and thrust agents, responsible for the investigation, to center stage.

This increased publicity has led to greater cooperation by the public. Many investigations began from "tips."

A small hole in one of four crates bound from Brazil to Canada, noticed by airline officials at Kennedy Airport during a stopover in New York in April 1972, led to the breakup early in 1973 of the largest ring of traffickers in illegal animal pelts ever uncovered.

The hole revealed that inside the crate were spotted cat pelts, not leathers as listed. Agents were called to investigate.

This initial seizure sparked an investigation that led through Central and South America, East Africa, Canada, and Europe and uncovered diverse interlocking arrangements for the illegal movement of large quantities of the skins of endangered wild animals.

As chief of the "brush cops," Clark Bavin, 36, does not convey a police image nor the image of a man of the bushes. Yet he heads a team of approximately 150 agents that often are exposed to danger—five have been killed since the Federal Government got into wildlife law enforcement in a big way in 1918, and each year about 10 agents are assaulted.

The Migratory Bird Treaty Act of 1918 provides authority for the agents to enforce the migratory bird hunting laws, and about half of all their wildlife prosecutions came under this statute. But passing years have added many wildlife laws on the books and more responsibilities for the agents.

The Bald Eagle Act of 1940 forbids the killing of bald and golden eagles, and this statute was applicable in a recent prosecution.

The Endangered Species Conservation Act of 1969 has become one of the most important. Under this statute any importation of wildlife species found by the Secretary of the Interior to be threatened with worldwide extinction is forbidden except for certain scientific and educational purposes. Agents are charged with examining imports at ports of entry. To facilitate enforcement, wildlife imports are restricted to eight principal locations: New York, Miami, Chicago, San Francisco, Los Angeles, Seattle, New Orleans, and Honolulu.

Agents obviously have a broad range of responsibilities. They must possess knowledge not only of law enforcement procedures, but also of wildlife species, hunting, wildlife management, and Fish and Wildlife Service programs. Hence, entrance requirements have gradually been stiffened and, as a rule, agents have from 4 to 10 years field experience with a State fish and game agency before being hired by the Service.

Standards have risen dramatically from the days when many wardens were political appointees and received no pay other than from fines collected. Now game management agents have a combination of high Civil Service grade plus additional "premium pay" in lieu of overtime.

Even critics would admit they earn every bit of it, considering that they deal with law violators carrying loaded firearms, and in places remote enough to tempt resistance.

Nor are they always after "small time" violators. Frequently their targets are what is termed market hunters—those who take ducks or other wildlife in large quantity in the hopes of making commercial profit.

They conduct undercover operations to keep illegal buying and selling of wildlife under control. One of the best undercover men in the business was Anthony Stefano, whose work in purchasing more than 5,000 wild ducks and geese while posing as a peanut salesman led in 1961 to the largest raid in Fish and Wildlife Service history—a roundup of 161 persons

for market hunting activities in five southeastern States.

Another undercover operation paid off in the convictions of 35 persons, many of them wealthy sportsmen, who paid fees of up to \$3,000 each to shoot illegally one of the protected bighorn sheep on secretly organized safaris into the mountains east of San Diego.

The organizer of those hunts was even a director of a group dedicated to saving bighorn sheep. His post as a director provided him with knowledge about the species which is sought by sheep hunters wanting to complete a "grand slam," i.e., the killing of a Rocky Mountain, Stone, Dall, and desert bighorn. Hunting the latter has been outlawed in California since 1872.

To crack this case, Agent Robert Halstead from Dover, Del., was assigned to pose as a big-game hunter and make contact with the arranger. Halstead agreed to pay \$2,500 (the money was supplied by California's Department of Fish and Game working in cooperation with the Service) to be taken on a hunt, where subsequently a bighorn sheep was killed by the guide who had organized the illicit hunts. Confronted with the evidence, he later pleaded guilty to State felony charges in California.

Federal charges were brought against the conspirators residing outside California. They were charged with violating the Lacey Act, another Federal wildlife statute that forbids the interstate shipment of game illegally killed under State regulations. All of those persons paid fines or forfeited their trophies.

The game management agents obtain a conviction rate of 97 percent in the wildlife cases prosecuted.

The agents believe they now have the legal tools, given the public's environmental awakening, to make real progress toward preserving the Nation's wildlife.

According to reports from agents in the field, the Endangered Species Conservation Act of December 1969 is helping to bring back some species from the verge of extinction, including the alligator, by depressing prices that poachers can obtain for skins. Apprehensions of alligator poachers have declined by as much as 75 percent in many areas mainly because there are fewer poachers. New State laws also are helping.

If America does save its endangered wildlife, Uncle Sam's game management agents will be due much credit for the rescue.

A Trail and a River for our Safe-Keeping

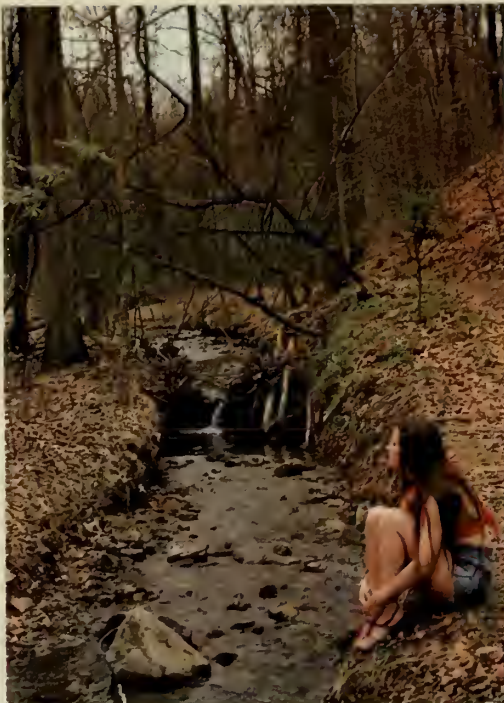
One clear day in 1968, a man and woman carefully affixed bright tape to shrubs and tree branches, marking a trail route along the hillside north of Oak Ridge, Tennessee. Later, equipped only with rakes and pruning shears and working in their spare time, Mr. and Mrs. William and Liane Russell cleared low-hanging branches to make a narrow footpath completing the first segment of what later became the 7½-mile North Ridge National Recreation Trail.

When the Russells began, they scarcely suspected they were blazing a trail of national significance. But by working on their own initiative, and aided by the Interior Department's Bureau of Outdoor Recreation, they were to make an important contribution to the National Trails System and thus to recreation.

Mr. & Mrs. Russell, both geneticists at the Oak Ridge National Laboratory, began the project in the mid-1960s by studying the approximately 1,800 acres of "greenbelt" areas (for the most part still wooded) in and around Oak Ridge. They knew that the survival of the greenbelts' wilderness qualities in future years would depend upon the degree of citizen interest in these vital areas. Although the land was city-owned, few people explored the woods so close to their back doors, the Russells believed, because of a lack of knowledge of their location or their availability for public use.

It was a problem common to many communities. In this case, the people of Oak Ridge had yet to discover the nearby solitude of oak and hickory forests and steep, spring-fed valleys lush with fern. Within easy hiking distance, too, were broad, pleasant valleys with an old homesite or two now overrun with honeysuckle, plus numerous birds and animals making their homes amid towering beech trees and the plentiful mountain laurel.

Trails for pleasure walking, nature study, and photography, the Russells decided, could be the right tool to introduce Oak Ridgers to these special places. That an introduction was



Designed to take maximum advantage of the scenic natural contours of the land, the North Ridge National Recreation Trail in Oak Ridge, Tennessee, leads hikers to wilderness settings just a few miles from city streets. Urban residents find quiet relaxation and solitude near their homes.

needed soon became apparent in 1965 when the city proposed to cut a 60-foot-wide swath along the entire length of Black Oak Ridge to route a powerline where the North Ridge National Recreation Trail now winds.

Oak Ridge's greenbelts were not the only areas being eyed for powerlines or like development. Across the State, similar proposals threatened many superb wild lands and waters. To encourage long-term planning and preservation of these unique resources, the Russells helped found in 1966 an organization dedicated to the care of the State's natural environment, the Tennessee Citizens for Wilderness Planning (TCWP). Although most of the group's efforts have concentrated on river preservation and strengthening strip mining regulations at the State level, a greenbelt trails committee formed within the TCWP to plan a network of Oak Ridge trails with the consent and cooperation of city officials. Led by Lily Rose Claiborne, an Oak Ridge homemaker and conservationist, the committee mapped a footpath extending from the original trail cleared by the Russells along the top of Black Oak Ridge.

Over the next two years, volunteers extended the trail to 7½ miles, accessible from feeder paths off five city streets. Trail making was not the only work the TCWP undertook, however. To arouse and maintain citizen interest in the North Ridge, they led group hikes on the trail, placed an exhibit in the local Earth Day Fair in 1970, worked with the media, and frequently kept in touch with local officials, especially the city planner.

As the trail neared completion in 1971, the Department of the Interior sponsored a National Trails Symposium in Washington, D.C. There, Secretary Morton announced the addition of 27 National Recreation Trails to the National Trails System. Created by Congress to encourage Americans to explore the great outdoors, the System is made up of scenic trails designated by the Congress, and recreation trails designated by the Secretaries of the Interior or Agriculture. Scenic trails are generally long-distance footpaths which must possess outstanding historical, cultural, natural or scenic values; recreation trails, varying in length, are usually located near urban areas, and may be designed for "multiple use" such as hiking and bicycling.

Back home in Oak Ridge, the TCWP

studied existing National Recreation Trails. They decided that if the North Ridge Trail were to become part of the national system, this recognition not only would be an honor for city and State, but also would improve the greenbelt's chances of protection from development.

At the request of William Russell, backed up by a promise from the TCWP to maintain the trail, the Oak Ridge City Council filed an application for national trail designation through the State Department of Conservation to the Bureau of Outdoor Recreation (BOR).

Recreation specialists of the BOR studied the trail to make sure it met the requirements of a National Recreation Trail: it had to be close to urban populations and pass through or provide access to significant features of the area; it had to be ready for use; and there had to be proof that for at least the next ten years the trail would be open to the public for recreational purposes.

The North Ridge Trail appeared to meet these criteria, so a BOR representative made an on-the-spot inspection in September 1972. Together with the Russells, Lily Rose Claiborne, and the city planner, he hiked the trail. Impressed by the well-planned trail with beautiful surroundings and color-keyed trail markers, he recommended the trail for inclusion in the national system.

In early 1973, Secretary Morton officially proclaimed the Oak Ridge pathway as the North Ridge National Recreation Trail.

Dedicated people like the Russells and other TCWP volunteers work every day—in government and in the private sector, as volunteers and paid staff—to encourage more outdoor parklands and pathways where Americans can explore nature far from the noise of city streets.

Not all recreational pathways are confined to land, however. Waterways are important natural pathways, and many of these are protected in the Nation's Wild and Scenic Rivers System.

"Here in the Midwest . . . our rivers are our trails—indeed our wilderness—and are our principal opportunities for developing and deepening our appreciation for the natural world. . . . With few exceptions, only on our rivers can we travel for miles with only an occasional reminder of urban civilization." (Jonathan P. Ela, October 1971 Congressional hearings on a bill

to add the Lower St. Croix River to the Wild and Scenic Rivers System)

The Wild and Scenic Rivers System encourages the protection of free-flowing rivers for their "remarkable scenic, recreational, geologic, fish and wildlife, historic and cultural values" in the same way that the National Trails System encourages the establishment of trails to foster our enjoyment and appreciation of the "open-air, outdoor areas of the Nation."

A recent addition to the rivers system is the Lower St. Croix River. How it received this national recognition is another story of citizen action aided by people in all levels of government. Unlike the relatively little used greenbelts of Oak Ridge, however, the Lower St. Croix had long been an important resource to the people of the St. Croix Valley. They knew the river well—and they believed that it deserved some form of protection. The problem was to determine how and from whom this protection would come.

Probably named after a French fur trader, the St. Croix markedly changes character on its 165-mile course from northern Wisconsin to the Mississippi River. For part of the way, it serves as the boundary between the States of Minnesota and Wisconsin. The Upper St. Croix, north of Taylors Falls, Minnesota, is one of the Nation's last wild rivers, with extended stretches of white water bordered by rustic woodlands. The Lower St. Croix, south of Taylors Falls, rushes through a spectacular narrow gorge called The Dalles where walls of high smooth rock built by ancient lava flows and glacial deposits provide a fascinating lesson in geology. Further south, the river widens and runs more slowly through fertile farm country and forested bluffs now mushrooming with urban expansion of nearby Minneapolis and St. Paul, located only one-half hour's drive away. The Twin Cities area is the third-fastest-growing metropolitan region in the Nation.

The Upper St. Croix became part of the Wild and Scenic Rivers System when Congress passed the Wild and Scenic Rivers Act in 1968. The same law required that the Lower St. Croix be studied by Interior to determine its suitability for possible later inclusion.

Efforts to preserve the Lower St. Croix began a number of years before the 1968 study requirement. A powerplant built on the shoreline in the early 1960s aroused the fears of citizens that industrial and urban development would soon envelop and pollute the



In recommending approval of the Wild and Scenic Rivers Act, the Secretaries of the Interior and Agriculture declared: "America's rivers flow deep through our national consciousness. Their courses beckoned us to explore a new continent and build a Nation, and we

have come to know, depend upon and love that water."

One of the rivers preserved under that Act is Wisconsin's St. Croix River, which is being protected for its natural and scenic values. Here are three scenes along the St. Croix.

St. Croix as it had the nearby Minnesota and Mississippi Rivers. With this in mind, the citizens banded together to "save the St. Croix."

Partly as a result of this citizen concern, the two State governments established the Minnesota-Wisconsin Boundary Area Commission in 1965. The Commission was directed to plan for the protection, use, and development of the interstate boundary lands and waters.

From its founding, the Commission has served as the focal point for efforts to protect the St. Croix. Its modest Hudson, Wisconsin, offices are equipped with a phone, typewriter, mimeograph machine, and two-member staff of which Jim Harrison is director. Anyone seeking information on the Lower St. Croix would probably find it in Harrison's shop. For the past eight years, the office has collected and disseminated river news to conservationists, local residents, Federal and State officials, and the media.

The team studying the river's suitability for national designation worked out of the Commission's offices, too. The Bureau of Outdoor Recreation led the study team, composed of representatives from other Federal agencies, both States, and the Commission's Jim Harrison. Shortly after the study began in 1970, Harrison organized a conference where BOR representatives explained the study mission to the local citizens.

BOR's preliminary study report of October 1971, prepared after extensive study, on-the-spot field trips, and meetings with local citizens, recommended adding the Lower St. Croix to the Wild and Scenic Rivers System: the northern portion as a scenic area, the southern portion as a recreational area. These categories plus a wild river area were established in the 1968 Wild and Scenic Rivers Act. All must be substantially free-flowing and unpolluted, but wild river areas must be primitive and generally inaccessible except by trail; scenic river areas must be largely undeveloped but accessible by road; recreational river areas may have extensively developed shorelines and be readily accessible by road.

One year later, following Congressional hearings and agreements between Federal and State agencies on how the river would be managed, President Nixon signed into law a bill adding the Lower St. Croix to the Wild and Scenic Rivers System.



Preserving Stony Creek

For Dr. Sarah Van Hoosen Jones the National Park Service's National Register program was the capstone to a lifelong struggle to preserve her childhood home, Stony Creek Village, Michigan.

Dr. Jones' grandfather, Joshua Van Hoosen, was brought by his family to Stony Creek in 1837 when he was 6. He grew up there, married Sarah Taylor, granddaughter of the village founder, and by the time his granddaughter Sarah was born in 1891 he had accumulated most of the original Taylor farm.

Stony Creek Village remained a village while nearby Rochester and other towns developed and prospered. When Dr. Jones inherited her grandfather's farm she discovered that almost all the buildings there predated the Civil War.

Determined to preserve the farm complex and keep the associated village intact, Dr. Jones took up the study of agriculture and farm management, receiving a Ph. D. in animal genetics from the University of Wisconsin in 1921.

She immediately returned to Stony Creek and successfully managed the family farm. Her success as a farmer led to two six-year terms on the Michigan State Board of Agriculture during which time she helped Michigan State College grow from a 6,000-student agricultural school to the 20,000-student Michigan State University.

During all her career she sought the ways and means of protecting and preserving Stony Creek Village as a part of America's agricultural heritage. Her efforts found success in June 1972 when the Stony Creek Village Historic District, covering 35 key areas of the farm and 17 buildings was formally recognized in the National Register of Historic Places, maintained by the National Park Service to encourage preservation of significant non-Federal holdings.

Dr. Jones lived to savor this recognition for only two months, but her achievement will live after her. She left the picturesque village to Michigan State University, which has agreed to continue the operation of the farm and to preserve Stony Creek Village for future generations of Americans.



Exceptional foresight by Dr. Sarah Van Hoosen Jones led to the setting aside of her childhood farm-home and surrounding Stony Creek Village in Michigan as part of America's agricultural heritage. Most of the farm's 17 buildings were erected before the Civil War. The unusually well-preserved farm and buildings were left to Michigan State University, which will operate the farm and preserve Stony Creek Village.



Responding to Disaster

In the summer of 1972, torrential rains cascaded off the Eastern slopes of South Dakota's Black Hills, and Tropical Storm Agnes ravaged parts of West Virginia, Maryland, Virginia, New York, and Pennsylvania.

In South Dakota, 240 lives and \$100 million in property were lost. Twelve days after the flood, John Andrick, an outdoor recreation planner from the Bureau of Outdoor Recreation's Denver office, viewed the devastated flood plain. Amid the grief, rubble, and mud was the question: "Did this have to happen?"

While emergency conditions were still in effect, John and many other planners began to coordinate rehabilitation efforts through the Mountain Plains Federal Regional Council, a unifying agency created by President Nixon. Interior Secretary Morton directed BOR to encourage State and local governments to implement sound flood plain management practices.

Immediately following the flood, recovery efforts began in Rapid City, the hardest hit area. But with recovery programs came innovative post-flood planning. People began to realize that there must be a way to lessen the impact of flood damage.

In this atmosphere, BOR met with other government agencies.

The Council focused its attention primarily on helping communities rebuild and plan uses for their flood plains which would minimize the possibility of future damages. Because of BOR's previous experience in flood plain planning, it was able to contribute much to the Rapid City planning effort.

The result was a plan which called for low density use of a 30-mile segment of the Rapid City flood plain. This section of flood plain, which extends from the town of Hisega in Black Hills National Forest to the Rapid City municipal airport, would be rehabilitated in five separate projects.

Each of the five units, exhibiting slightly different approaches to flood plain management, would provide a

sparsely developed flood plain of varying widths.

One of the first projects to mature was a 210-acre land acquisition in Pennington County. A \$959,000 Land and Water Conservation Fund grant will be matched with local funding and grants to purchase land and later provide construction of very limited recreation support facilities such as trails, small parking areas, and the re-establishment of natural areas.

Rapid City, working with the Department of Housing and Urban Development, will develop an open flood way on the Rapid Creek flood plain. Residents and "non-submersible" structures will be relocated, and the land will be utilized as an integrated recreational/open space/communities zone. This project proposes to acquire practically all of the flood prone lands of the unit.

The final unit of the rehabilitation program will involve a flood plain zoning area in Pennington County's downstream portion of Rapid Creek. Good flood plain management will be implemented in a program of regulation rather than acquisition. Once again the end result will be a sparsely developed flood plain which has been dedicated to submersible uses.

As South Dakota gradually recovered from the flood devastation, Tropical Storm Agnes began her rampage up the eastern coast, wreaking vengeance along her route, saturating the ground, and swelling rivers and streams. Much of her fury was inflicted on Pennsylvania.

The storm killed 44 persons in the Keystone State and ruined thousands of homes, parks, play areas, factories, and businesses. It drowned livestock and destroyed \$35 million worth of growing crops. Thousands of miles of roads were temporarily closed, and telephone, electric, gas and water services were cut off.

Termed the "greatest disaster in the history of the State," Agnes did \$1.5 billion in damage to Pennsylvania.

The human costs of Agnes were incalculable. People—dazed and shocked from the loss of loved ones, homes, and possessions—looked to State and Federal governments for help.

Seeing that the human needs came first—food, clothing, housing, and cleanup.

Then, in August, BOR's Northeast Regional Office in Philadelphia received a call from Frank Carlucci, then Deputy Director of the Office of

Management and Budget and President Nixon's on-site representative. Carlucci asked Regional Director Maurice "Red" Arnold to provide staff for the Federal Emergency Task Force on the job in Wilkes-Barre. BOR's assignment was to develop a total recreation program for the flood-devastated areas of the Wyoming Valley on the Susquehanna River, including Wilkes-Barre and many nearby communities.

In less than a week, BOR staff members on the scene had prepared a \$7.5 million proposal, including about \$1.8 million for a recreation-social activities program and about \$7.5 million for temporary buildings and renovation and development of existing playfields and parks.

The two-year program helps to meet the recreation needs of 300,000 persons residing in about two-thirds of the valley, including over 100,000 displaced flood victims living in temporary housing. While providing for the immediate recreation needs of the people, the program is geared to encouraging future wise land use planning on flood plains.

People involved in the South Dakota floods and Tropical Storm Agnes learned how effectively flood plains can be used for much needed open space and outdoor recreation areas. The 1972 floods also were a lesson to all levels of government and private citizens: Wise land use planning is a must.

Earthquake!

Early in the morning of December 23, 1972, the ground beneath Managua, Nicaragua, abruptly heaved and then shook intensely for the next minute or so. In that brief period of time, much of the older, central part of the city tumbled to the ground, killing thousands of people and starting raging fires that swept through the devastated area. Word of the disastrous earthquake spread quickly around the world. In Menlo Park, California, three U.S. Geological Survey scientists began preparation for visiting Managua in search of information that might prove invaluable to the earthquake hazards investigations conducted by the Geological Survey in the United States.

Two of the scientists made an on-the-ground geological investigation of the

city. Careful searching for surface fracturing led to the discovery that the earthquake formed four main systems of ground cracks that crossed the city from southwest to northeast. Close inspection of these cracks revealed that the ground not only split slightly open along their length, but that the southeastern side of each crack moved slightly to the northeast, with respect to its northwest side.

It is noteworthy that the orientation and sense of movement of these cracks were essentially the same as were displayed by the ground cracks that formed during the destructive earthquake of 1931. This similarity suggests that the patterns of geological stress that caused the 1972 earthquake were similar to those in 1931. It is reasonable to expect that the stress buildup prior to the next damaging earthquake may be of much the same character.

The third member of the Survey team, a seismologist, rushed to Managua in an effort to study the sequence of aftershocks that continued to jostle the city for many days after the main event. Portable seismometers recorded more than 200 aftershocks. Analysis of these data has revealed that the epicenters of the aftershocks lie along the very same trends as the ground cracks, and the implication is that the crust of the earth near Managua was still yielding long after the main earthquake had done its damage.

The results of these emergency investigations are still being interpreted by Survey scientists. The final results will provide a better understanding of the geological anatomy of Managua, and the lessons to be learned may help mitigate the disastrous effects of earthquakes the world over.

What's in a Name?

It has often been said that we remember places better than people. If this is true, it may be because we closely associate personal experiences, emotions, and feelings with particular places. The names we give and use for these places are an essential element in making our lives intelligible. Place names are important to us in many ways. As a part of everyday language, they allow us to communicate ideas about the world

around us.

Imagine, if you will, a world without names to identify its features and places. They identify areas of cultural and administrative responsibility and define political boundaries. They carry legal weight in determining property, mineral, and water rights. There are few activities that so closely parallel man's interests, experiences, and intellectual talent as the naming process.

The largest collection of American place names can be found on the 30,000 or more topographic maps published by the U.S. Geological Survey, Department of the Interior. It has been estimated that about 3 million place names are shown on these maps; about two-thirds of the names in present-day use. In a sense, these names are the language with which our country's autobiography is written. Over 500 years of American history are reflected in names like Snohomish, Florida, Sandy Point, Fond du Lac, Bald Knob, Uz, Yorktown, Kodiak, Athens, Mauna Loa, Arroyo Seco, The Maiden, Caintuck Hollow, Rough and Ready, Bean-Blossom Creek, and Independence. We have named a place for a Swedish soprano (Jenny Lind), a French crusader (Saint Louis), a Roman soldier (Cincinnatus), a Pirate (La Fitte), and a Russian Czar (Alexander). Our names echo every ingredient of life, past and present, recorded in over 100 languages and dialects.

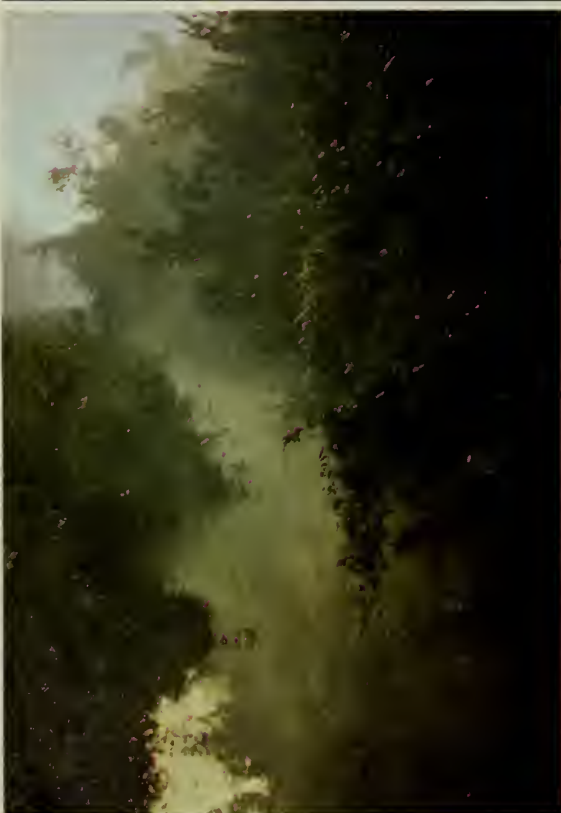
Perhaps more than anyone else, map-makers carry the burden of public responsibility for place-name usage. Names are not put on maps in an arbitrary manner. Every effort is made to use the best names possible—names most likely to endure in both local and published usage. The map maker tries to use names in present-day local usage, but he is also concerned with standardization of these names. Local usage and standardization have not always been mutually compatible in the past, nor will they always be compatible in the future. We are, however, in an age of intense and sophisticated investigations of the environment and other physical aspects of the land. Public and scientific needs are becoming intolerant of inexact labels for identification. Reliability is the sign of our times.

The Federal Government saw the need for place-name standardization on its maps as early as 1890, when the U.S. Board on Geographic Names was

established. The Board, an inter-departmental agency, was created in its present form by an Act of Congress in 1947. Its principal policy is to follow local usage whenever possible. Local duplication and derogatory names are exceptions to this policy. In approving new names for federal usage, the Board requires that they be distinctive and appropriate.

The greatest force for name standardization, however, is the map. As large-scale maps become more influential in our society, the printed name tends to crystallize local usage. Map makers, though, are still faced with name problems. Often more than one name is used for the same feature. This is a particular problem in areas where two cultures with different languages overlap. Name conflicts of this kind are common in Alaska and the Southwestern United States where large populations speak languages other than English. Spelling presents a difficulty in name standardization. Should it be Bulby Point or Bull Bay Point? Ants, Aunts, or Ance Creek? Indian and Eskimo names also pose problems in spelling. For example, a particular three-syllable Indian name in Alaska has fifteen recorded spellings. But perhaps the most perplexing problem map makers face is deciding on where names actually apply. Geographic features subject to naming range from discrete entities to vague forms. The meanings of names are generally conveyed in the context of conversation while the map maker is forced to apply names to specific features on maps. Where does the valley end and the mountain begin? Crosswise a river has definite limits, but lengthwise it becomes vague, especially with respect to its headwaters, which may be formed by several branches.

Standardization of names on maps often run contrary to somebody's wishes, and the shades of the founding fathers are sometimes invoked in asserting an inalienable right to "have our names left alone." A name that once was only of local concern, however, may now be of national significance—Cape Canaveral/Kennedy for example. The day may come when all our place names will be standardized with respect to form, spelling, and application. Nevertheless, Bumble Bee, Bridal Veil, Charlie Hope, Columbus, Hinkey Dinkey, Goose Pimple Junction, Mud Lake, Sleepy Eye, Blond, Brunette, Red Head, and the French Broad will still be with us.



The Great Dismal Swamp

The gift to the American people of a major segment of the Great Dismal Swamp in Virginia in 1973 was a classic instance of how voluntary acts by individual citizens, conservation groups, and private industry can combine to help save the Nation's outdoor legacy.

Early in the year, Union Camp Corporation, the land owner, and The Nature Conservancy, a private conservation organization, announced that the company was donating more than 49,000 acres, valued at \$12.6 million, to the Conservancy—which in turn would convey it to the Interior Department for use as a National



Dismal Swamp scenes. On February 22, 1973, Union Camp Corporation formally deeded its land holdings in the Great Dismal Swamp of Virginia for use as part of a new national wildlife refuge. Although the area has had virtually no human habitation, the Great Dismal Swamp boasts an unusually rich history. Action by Union Camp Corporation, The Nature Conservancy, and the Department of the Interior ensures that one of the most historic areas of the swamp will be preserved.

Wildlife Refuge.

Union Camp's gift is about 20 percent of the swamp's total remaining acreage in Virginia and North Carolina. The swamp is less than one-third its original size because of farming and development.

The agreement climaxed years of citizen action by lovers of one of the largest and most significant swamps in the eastern United States.

The Nature Conservancy provided technical and professional leadership. Grassroots action helped greatly in cataloguing the resources, analyzing land records, and enlisting public support. Alvah Duke, area resident and swamp aficionado, supplied much of the needed data. A group of Virginians led by Barbara Racine and a band of North Carolinians headed by Dr. Joseph Gill identified ownership patterns.

They determined that the largest tract, including the remarkable Lake Drummond, was owned by Union Camp. And the company was more than receptive to a donation plan. It had already decided to explore whether the Federal tax laws would make the financial impact of such a gift fully acceptable to Union Camp stockholders.

The Nature Conservancy's own account of how it all happened says that "special praise is due Union Camp's Board Chairman, Alexander B. Calder, Jr., and President, Samuel M. Kinney, Jr., who were reported by *Fortune* and *Business Week* to have seen conservation as the highest end use for the company's holdings in the Great Dismal Swamp."

Secretary Morton, in a message to participants in the transfer ceremony, said, "President Nixon has consistently challenged the American people to take personal responsibility for the preservation of our national heritage and the quality of our environment. As he has repeatedly said, the job to be done requires the best efforts of government at all levels, and participation by every citizen. . . . The ceremony today demonstrates exactly the kind of private, voluntary action the President has called for. I salute Union Camp and The Nature Conservancy, and I pledge our utmost efforts to conserve this outstanding natural resource."

The donated land is heavily forested; much of it was once owned by George Washington, Patrick Henry, and other prominent Virginians.

Situated within a few minutes'

drive southwest of a major population center—the thriving Norfolk-Hampton Roads port and industrial complex—the Dismal Swamp contains forms of plant and animal life seldom seen elsewhere. For some it is the northern end of their range; a unique native species is the Dismal Swamp short-tailed shrew. Seventy-five species of birds nest in the swamp, and one of the last native breeding populations of black bears in the East is there. Insects, fishes, frogs, mammals and a varied assortment of plants combine in a unique community.

Through three centuries, the Great Dismal Swamp of Virginia and North Carolina has enjoyed or endured the attentions of people who have challenged, cursed, coveted, claimed, celebrated, or cared for the swamp and its abundant resources of land, water, wildlife, trees, and space.

Depending on the impression the teller wanted to make on his audience, as well as the impression the swamp made on him, Dismal Swamp has been called many things—the epithets ranging from the sacred to the profane and back again from the ridiculous to the sublime. Poets, novelists, journalists, natural scientists, and describers of all sorts have written about Great Dismal Swamp, but no one yet has managed to sum up the place exactly, to categorize it into a neat pigeonhole.

After his first two visits in 1763, George Washington described the Dismal Swamp as a "glorious paradise" for wildlife. Washington's description contrasted rather greatly with the earlier description by Colonel William Byrd II, who surveyed the State line across the swamp.

According to Byrd, Dismal Swamp was a "horrible desert" where "nor indeed do any birds care to fly over it . . . for fear of the noisome exhalations that rise from this body of dirt and nastiness. . . ." More recent observers have tended to prefer Washington's assessment of the Dismal Swamp as wildlife habitat, although Byrd claimed at least one animal for the swamp never reported by anyone since—the alligator.

One thing is agreed upon by all: the Great Dismal Swamp is not an ordinary or typical swamp. It is a place where nature has done its work, and where man has made a part of his history. With its future now made brighter, the swamp promises to retain its many important meanings for generations to come.

Checking Chemical Elements

Our natural environment consists of chemical elements combined in various ways to form minerals, rocks, soil, water, air, and organic materials. Superimposed on the natural environment are the effects of chemical pollution which have greatly altered portions of the environment. Scientists of the U.S. Geological Survey are conducting geochemical investigations to evaluate the effect of both pollution and natural geochemical variations on human and animal health.

To evaluate geochemical changes caused by pollution, it is important to have geochemical data on the natural state, or what is called "baseline geochemical data." Such data have been obtained in parts of Georgia and Kentucky and are currently being collected in Missouri by Survey scientists in collaboration with the Environmental Health Surveillance Center of the University of Missouri at Columbia.

One important result of the "baseline" work in Missouri is the discovery that the trace element contents of vegetation are, in large part, independent of the chemistry of the soils. For example, a State-wide study of corn grown in all types of Missouri's widely varied soils indicates that all the corn had about the same trace element composition. Similar results have been found for soybeans, grasses, and several other plants. These studies suggest that the chemistry of food plants is nearly constant unless unusual geological conditions or the effects of pollution

have caused extreme changes in an environment. A nationwide project on the geochemistry of food plants has been initiated to study this matter further.

Another study in Missouri illustrates the use of baseline data to determine the cause of soil pollution. In a small area of the central part of the State, cattle suffered metabolic disorders that were apparently caused by an imbalance of minerals or other nutrients in their diets. A geochemical survey of the area was made which showed that a number of chemical elements were being introduced into the local environment in anomalous amounts. The study revealed that the source of the elements was an abandoned clay-mining operation upstream from the pastures. Comparison of the chemistry of local plants, soils, and water with the baseline data that had been accumulated for similar, but unpolluted, environments throughout the State led to the discovery.

Accumulation of additional baseline data for other large regions of the nation is regarded as an important part of the Geological Survey's program in geochemistry. Such data may help to clarify the relationship of natural geochemical variations to human and animal health. The World Health Organization is interested in the relationship of heart disease to geological and geochemical environment and is conducting an investigation of the problem in which Geological Survey personnel have participated.

An independent study in Georgia by Geological Survey personnel, in cooperation with the U.S. Public Health Service, revealed that the rate of heart disease was distinctly higher in the central part of the State where the soils are deficient in trace elements, as compared with the conditions in the northern part where soils differ and where the heart disease rate is low. Although further investigation is needed, the study suggests that a natural geochemical variation in the soil is a possible factor in the divergent heart disease rates. Both human and animal health can be adversely affected by chemical pollution, but evidence is rapidly accumulating which shows that natural geochemical variation may also be important. Much more work, based on plausible hypotheses of the causal relationships of specific chemical elements to specific diseases, appears needed to quantify relationships of the geochemical environment to health.

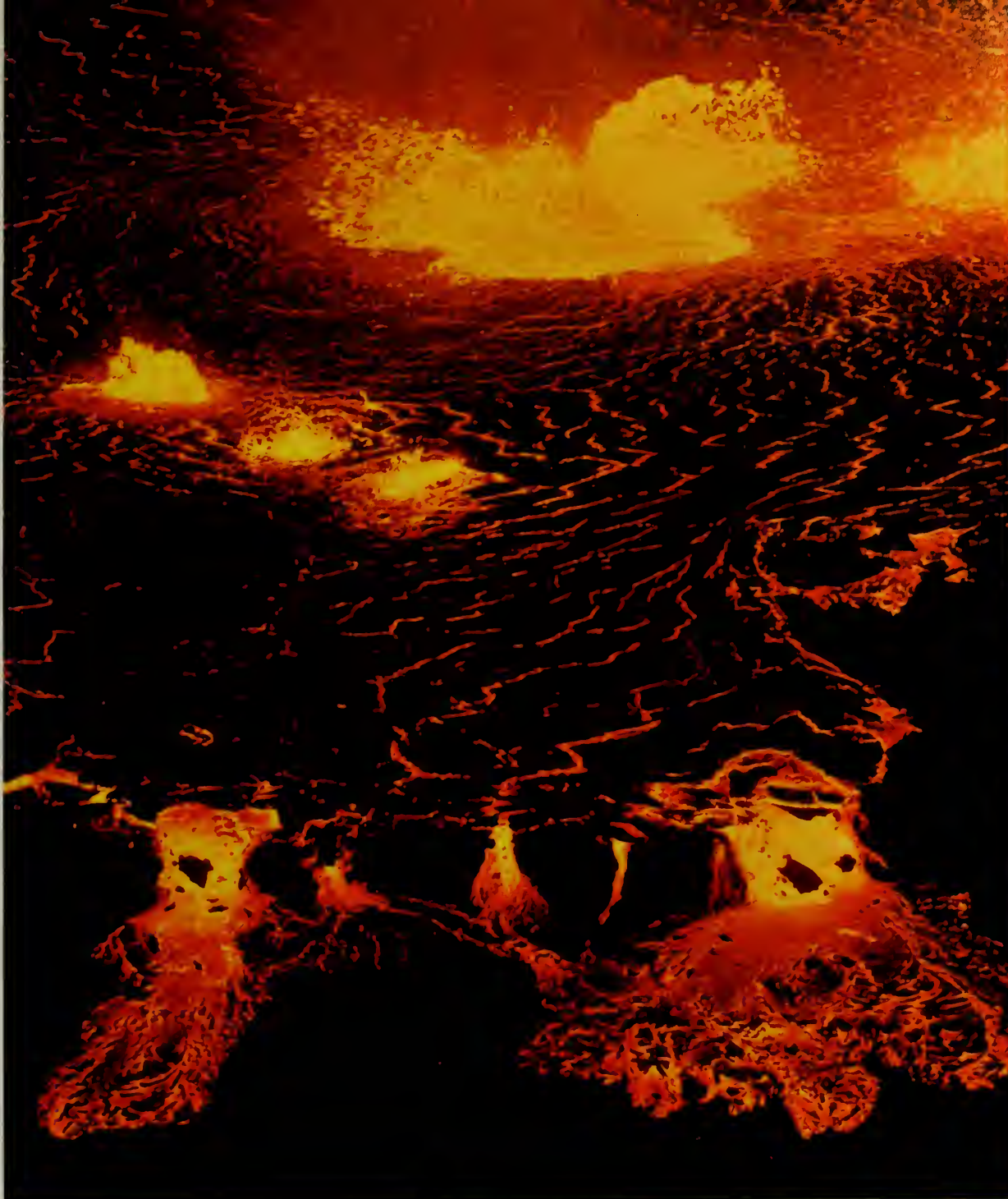
Volcano Watch

Like firemen, scientists of the U.S. Geological Survey's Hawaiian Volcano Observatory are on constant alert. The Observatory is located at the summit of one of the world's most active volcanoes . . . Kilauea, on the island of Hawaii. Here since 1948 Survey volcanologists have continually taken Kilauea's "pulse" through a variety of instruments and techniques, and events of recent years have kept the volcano watchers at a high level of activity.

Kilauea erupted three times in 1967-68, and since 1969 the volcano has been, virtually, in a continuous state of activity. Much of the time, lava wells quietly up to the surface, but for brief periods it has jetted to great heights. In December 1969, lava fountains reached heights of 1,600 feet, about three times the height of the Washington Monument. The newly erupted lava has spread out through a wide area of jungle within Hawaii Volcanoes National Park. Some large lava streams have cascaded over stair-step cliffs to the sea, 8 miles distant and about 3,000 feet lower in altitude. Huge volumes of the lava have poured into the sea, where it has been quenched to form black volcanic glass, which advances to the sea as a large-delta-like mass.

Survey scientists have kept close tabs on this process. One scientist, using scuba gear, has obtained an unprecedented view of incandescent blobs of lava tumbling and oozing down the steep front of the advancing lava delta.

Eruption and entry of lava into the sea has taken place countless times in the recent geologic past, and indeed, it is this very process that has built the Hawaiian Islands. The Survey's volcano watchers have ring-side seats for one of nature's more spectacular shows.



In more than four years of almost continuous activity, Hawaii's Kilauea Volcano has erupted huge volumes of lava in what scientists of the U.S. Geological Survey term the largest and most varied period of eruptive activity in the recorded history of the volcano.

Since May 1969, Kilauea, one of the world's most active volcanoes, has produced a total of more than 440 million cubic yards of lava (an average of about 300,000 cubic yards per day), which has buried between 25 and 30 square miles of surrounding ranchland and forest.

USGS scientists, from the Survey's Hawaiian Observatory, located at the very "lip" of Kilauea, are able to monitor the activity continuously.



Worldwide Effort to Save Endangered Species

The people-to-people involvement of the Fish and Wildlife Service extends across international borders now more dramatically than ever.

Service officials early in 1973 participated with the representatives of 80 countries in negotiating a worldwide convention to regulate international trade in endangered species.

Trade is prohibited in 178 species of mammals, 113 birds, 44 reptiles, 26 mollusks, 8 fishes, and 6 amphibians, among them five of the great whales and most of the world's spotted cats. Another 239 species of animals can be traded only if accompanied by a valid export permit.

"What I find most amazing," Secretary Morton said of the conference, "is that 80 different nations with highly divergent views reached all their conclusions by consensus. There were some 150 amendments to the basic working paper, yet accord was reached on this complex document without a single clause being put to a vote. The questions were either worked out in committee or in the corridors," he said.

Wildlife conservation is one of 11 specific areas designated to implement the Agreement on Cooperation in the Field of Environmental Protection, signed in Moscow by President Richard Nixon and Chairman of the Presidium of the Supreme Soviet N. V. Podgorny on May 23, 1972.

The Service's Dr. Joseph P. Linduska headed an American team of wildlife experts who met with their Soviet counterparts in Moscow in February 1973, with another meeting scheduled for Washington in September.

The two countries are drafting a treaty for the protection of migratory birds and this year are beginning several other cooperative wildlife programs.

"The treaty should engage the Soviets more actively in studies of bird migration patterns and population levels," Dr. Linduska said. He indicated that eventually the two countries may agree on common regulatory

measures for certain species. "The meetings revealed to us that waterfowl in the United States and Soviet Union face many of the same problems, especially from drainage of nesting areas and other land use changes," Dr. Linduska said.

The following other cooperative programs were underway in 1973, all agreed to in the Moscow meetings:

- Soviet scientists accompanied Dr. Robert W. Elsner of the Scripps Institution of Oceanography in a study of the biological adaptation of northern marine mammals in the Bering Sea.

- Scott McVay of the Environmental Defense Fund headed a joint team during studies of the bowhead whale, which resides only in Arctic waters. Scientists hope to develop a census technique to index population size and trends for this species, now one of the rarest of the great whales. Bowheads, although protected from commercial whaling, remain important to the subsistence economy of several Siberian villages and to Eskimos in Alaska. Logistical support is being supplied by the Naval Arctic Research Laboratory at Point Barrow.

- Soviet scientists joined Dr. William Sladen of Johns Hopkins University during the summer in his studies of the migration and ecology of northern swans through use of banding, colored neck collars, and radio telemetry.

In addition to these studies, Dr. Linduska said that the two countries agreed to a "formal exchange" of information on endangered species.

"The United States and Soviet Union have much to learn from each other," Dr. Linduska said. He was impressed with the work underway at the Voronezh and Oka-Terrace State Preserves visited by the American team during the stay in the Soviet Union.

"The Soviets exhibited a high degree of competence in wildlife husbandry at Voronezh," Dr. Linduska said.

"Their use of tranquilizers to immobilize wildlife for purposes of study and transplant are highly refined."

The American group witnessed a tranquilizing demonstration on European moose and red deer (similar to American elk) at Voronezh, where beaver and wild boar also are being managed on the preserve 400 miles southeast of Moscow.

At Oka-Terrace, 100 miles southwest of Moscow, the U.S. group spent the day reviewing breeding experiments underway with the once nearly-extinct European bison.



(Top) Dr. Joseph P. Linduska, Associate Director of Fish and Wildlife Service, headed an American team of wildlife experts that met with Soviet counterparts in Moscow to discuss cooperative conservation program.

(Middle) Use of tranquilizers to immobilize wildlife for study and transplant purposes is a highly refined technique in the Soviet Union.

(Bottom) The welcome sign was out for the American team of wildlife experts.

On both areas, Dr. Linduska observed many nest boxes for songbirds and flying squirrels. Biological control agents to suppress forest insects were widely employed.

"There is evidence that the Soviets are ardent outdoorsmen," Dr. Linduska said, observing that a statistic of 30 million to 35 million Russian hunters is about double the American figure.



The Big Cleanup

The need to improve and protect our environment is one of the major challenges facing the Nation today. A key domestic issue that cuts across political, economic and geographic boundaries, it has captured the attention and involvement of many thousands of Americans.

Recognizing citizens' increasing concern about the environment, the Department of the Interior's Johnny Horizon '76 Program helps channel their commitments and talents into positive action.

With its "Let's Clean Up America For Our 200th Birthday" slogan, Johnny Horizon '76 promotes the development of environmental awareness among all sectors of society and supports a wide range of improvement projects. It is using to full advantage America's emerging environmental ethic.

An expansion of a program launched in 1968 by the Bureau of Land Management to clean up litter on public lands, Johnny Horizon '76 is now department-wide, and all Interior bureaus support and participate in the campaign.

Recognized by the American Revolution Bicentennial Commission as an official National Bicentennial activity, Johnny Horizon '76 is cosponsored by a growing list of Federal agencies including: Department of Defense Domestic Action Program, (Army, Navy, Air Force and Marines), U.S. Army Corps of Engineers, Civil Service Commission, Federal Highway Administration, General Services Administration, The President's Council on Environmental Quality, U.S. Postal Service, and Tennessee Valley Authority.

Leading the campaign at the local and State levels are more than 1,500 groups and individuals actively serving as sponsors and thousands of others who have joined in partnership with Johnny, the program's symbolic character. These supporters take on many kinds of activities to further the campaign's objectives.



(Top) Randy Sparks and The Back Porch Majority emphasize with music for Johnny '76 message; (Left Top) Henry Gibson and Burl Ives enlist student support; (Left Middle) actress Cicely Tyson asks television viewers to join the nationwide campaign; (Left Bottom) Johnny's partners set examples for everyone to follow; (Right Top) youngsters in Washington, D.C., hold a cleanup near their school; (Right Bottom) other volunteers spruce up a building to help "Clean Up America For Our 200th Birthday."

In the area of environmental education, Johnny Horizon '76 and its sponsors distribute a classroom kit to help teachers introduce youngsters to ecology, integrate environmental study into the basic curricula, and organize classroom projects. Interior, cosponsoring government agencies and private sponsors distributed more than 100,000 kits during the 1972-73 school year.

Johnny Horizon '76 distributes adult educational materials on various topics and encourages seminars and lectures. Interior bureaus conduct educational presentations in their respective areas.

Other supporters helping with environmental education include Burl Ives and the well-known children's publication, *My Weekly Reader*, which reaches more than 11 million children and 300,000 teachers.

Ives appears on children's television shows and visits schools to tell youngsters about Johnny Horizon '76. *My Weekly Reader* sponsors an ecology club for youngsters, features Johnny Horizon '76 and environmental stories in its newspapers and, in the fall of 1973, held a Johnny Horizon '76 cleanup week for students. The publication received the 1972 Johnny Horizon '76 National Award for its contributions to the campaign.

Johnny Promotes Awareness Projects

Johnny Horizon '76 also carries its "Let's Clean Up America" message to the public through concerts, radio and television public service announcements and advertisements in national news and association publications.

Concerts were held in 1972-73 in California, Florida, Oregon, and New York. Ives, Karon Blackwell, Lyle Moraine, Peter Hurd and Randy Sparks and The Back Porch Majority donated their time and talents for concerts. Ives, Cicely Tyson, Charles Schulz and Red Buttons were among celebrities who appeared in public service announcements broadcast by more than 2,500 radio and television stations.

The Wm. Hengerer Company, a multi-unit, Buffalo, New York, department store, is one of the many businesses which organized Johnny Horizon '76 awareness programs in 1972 and 1973. In cooperation with a local television station and clubs, Hengerer's introduced 600,000 persons to Johnny Horizon '76 objectives; held environmental parades, rallies and breakfasts; and distributed

75,000 recyclable shopping bags that featured the campaign slogan.

Burger Chef Systems, Inc.; Albertsons, Inc., a chain of grocery stores in the West; and Safeway, Inc. are other firms which have sponsored awareness projects.

Johnny Horizon '76 also sponsors environmental awareness projects at the local level. His partners display decals and posters, distribute leaflets and litter bags, feature exhibits in store windows, hold neighborhood Johnny Horizon '76 carnivals, sponsor nature walks and seminars, and sometimes print their own environmental newspapers.

Action Projects Initiated

Environmental awareness promoted by Johnny Horizon '76 leads to a variety of improvement projects—cleanups of inner-city, suburban, rural and recreation areas and waterfronts; beautifications; and recycling collections.

As the founder of Johnny Horizon and caretaker of 450 million acres of public domain, the Bureau of Land Management cooperates in various States with chambers of commerce and other civic groups in annual Johnny Horizon '76 cleanups. The National Park Service organizes cleanups and anti-litter projects in the Nation's parks. The Bureau of Reclamations and U.S. Army Corps of Engineers sponsor cleanups at water recreation sites. The Department of Defense, through its Domestic Action Program, supports volunteer cleanups in communities near military bases by providing manpower and equipment.

The Tennessee Valley Authority has shown that citizen cleanups can produce significant results. In 1972, TVA initiated campaigns involving more than 14,000 volunteers from 36 organizations—beautification committees, schools, scout troops, clubs and a National Guard battalion. The volunteers worked in four states and collected many tons of junk.

In Orange County, Florida, junior and senior high school students took the lead in encouraging a countywide Johnny Horizon '76 Cleanup Week in the spring of 1973. The Orange County Commission (Orlando) and County School Board cosponsored the event with Interior, the local National Alliance of Businessmen, merchants and nearly 4,000 school classes participating in the week.

The California Federation of Mineralogical Societies, National

Campers and Hikers Association, Idaho Federation of Women's Clubs and Florida Outdoor Writers Association are among others who organized large-scale cleanups in 1972 and 1973.

Since they exemplify the "I'll help, too" spirit, backyard, school and one-block cleanups are as important to the Johnny Horizon '76 goal as city, county and state-wide efforts.

In the thousands of letters the Program Office receives each month are reports of these cleanups. Children organize many of them—either in school or on their own. For example, a little girl from Modesto, California, started a "Clean Club," and a young outdoorsman in Colorado takes debris from the stream he travels in a kayak.

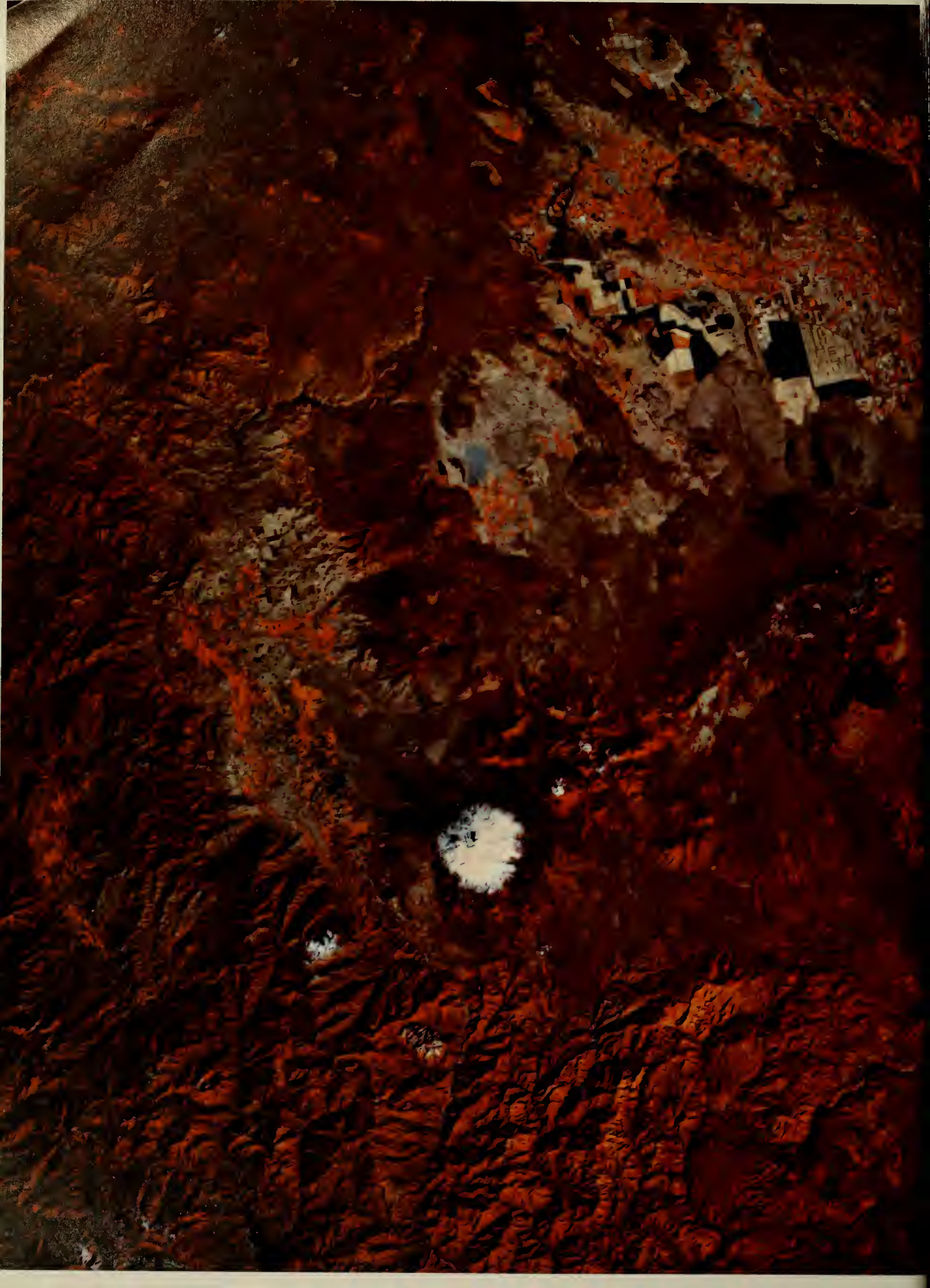
Beautification often is planned in conjunction with cleanups. In Buffalo, the Area Chamber of Commerce, beautification committee and task forces—all Johnny Horizon '76 sponsors—developed a long-range, self-perpetuating program, "Buffalo Beautiful '76." It includes not only cleanups but also beautifications, such as rehabilitations of vacant city lots and buildings, and the planting of grass, flowers, shrubs, and trees.

Collecting materials for recycling is an increasingly popular Johnny Horizon '76 project in areas where the necessary markets exist. Along with helping to reduce the drain on the country's natural resources, a recycling collection center offers community residents an opportunity to participate in an environmental effort and can provide funds to support other activities of non-profit organizations.

A sixth grade class from Floyd R. Shafer Elementary School in Nazareth, Pennsylvania, is one Johnny Horizon '76 sponsor that has a successful recycling collection operation. The class gives Johnny Horizon '76 campaign materials to donors of its center and uses profits to buy birdseed for five bird feeding stations on the school grounds.

The education, awareness, and action projects citizens have taken on in response to the Johnny Horizon '76 appeal demonstrate that every American can help the Nation meet its environmental challenge. The Department hopes that as the Nation looks forward to the celebration of its 200th anniversary in 1976, citizens will continue to unite with Johnny Horizon '76 symbol to help minimize pollution, prevent litter, clean up the air, water and land, and utilize natural resources wisely.

II THE GREAT ENERGY AND MINERALS SEARCH



Conservation of Energy is Major Interior Thrust

Although America has only six percent of the world's population, it consumes nearly a third of all the energy used in the world.

In 1972, U.S. demands for heat, light, and power in all forms required the energy equivalent of 72,091 trillion British thermal units—a 4.9 percent increase over 1971, and more than double the 2.4 percent rise from 1970 to 1971.

If the present energy growth rate continues, the United States use of energy in 1970 will double by 1985 and triple by 2000.

Acquiring an adequate supply of energy in its needed forms is one of the major problems of this decade. The energy challenge—which could become an energy crisis—requires ingenuity and vigorous action.

President Nixon's second energy message to Congress in April 1973 proposed broad efforts to make more energy available to the United States.

The President ended quota restraints on oil imports to bring more oil from overseas. He directed the Secretary of the Interior to take steps that would triple by 1979 the annual acreage

(Left) View of glacier- and snow-covered Mt. Shasta, California, area as seen from 500 miles above the earth by the first Earth Resources Technology Satellite (ERTS-1). The 13,000 square mile area (about 115 mi. x 115 mi. on a side) shown by this picture is imaged every 18 days, thereby giving earth scientists and resource managers a major new tool to understand and wisely use our land's finite resources. Change in seasonal snowcover is of great interest to hydrologists because precise measurements of snowmelt and runoff are important to optimum control of reservoir level behind the large dams which generate hydroelectric power or provide water for irrigation during dry seasons of the year. Volcanic and geothermal areas, such as Mt. Shasta, offer possibilities as regions where geothermal power generation may alleviate some of our dependence on fossil fuels for the generation of electrical power.

leased on the Outer Continental Shelf, beginning with expanded lease sales in the Gulf of Mexico in 1974, and including areas beyond 200 meters in depth. (By 1985, this accelerated leasing rate could increase annual energy production by an estimated 1.5 billion barrels of oil and five trillion cubic feet of natural gas). He proposed that gas from new wells, gas newly-dedicated to interstate markets, and the continuing production of natural gas from expired contracts no longer be subject to price regulation at the wellhead.

The President called for speedy construction of the Alaskan pipeline that would bring as much as two million barrels of oil a day from Alaska's North Slope to Valdez. He emphasized possible recovery of petroleum from oil shale and the production of energy from geothermal resources. He called for stepped-up research to develop low-cost, clean burning forms of coal; continued growth of the private sector's role in future nuclear development; and development of deep-water ports to accommodate larger ships that bring in oil.

To help save fuels, he directed that an Office of Energy Conservation be established in the Department of the Interior to coordinate Federal energy conservation programs.

"Nations succeed only as they are able to respond to challenge," the President said, "and to change when circumstances and opportunities require change."

A short time later, Secretary of the Interior Morton established the Office of Energy Conservation to coordinate all Federal energy programs. The new Office will work with government, industry, and others to promote efficient use and development of energy resources; conduct research on methods of improving the efficiency of energy usage; promote consumer awareness of the need for energy conservation; and develop contingency plans for nationwide power, fuel and mineral resource emergencies caused by natural disasters, civil defense emergencies or other interruptions of the Nation's energy and mineral supplies.

In June, the President ordered Federal agencies to reduce energy consumption 7 percent over the next 12 months. Secretary Morton is responsible for monitoring agency efforts and reporting progress to the President.

What is Energy?

What is energy? It might be described as the potential for action — the inherent basis for life, motion, change, force.

Experience points to a general principle underlying all transformations of energy. The total energy of an isolated system remains constant and cannot be increased or diminished by any physical processes whatsoever.

In other words, energy — like matter — can be neither created nor destroyed. Whenever it apparently disappears, it has been transformed into energy of another kind. The catch is that when energy is used, it becomes converted from its original form and is thereby less available to man — at least with his present technical tools.

Energy can be measured in many units, among them foot pounds, horsepower hours, kilowatt hours, calories, and the British thermal units (Btu's). All of these units have an exact, unvarying equivalence with each other.

Heat energy can be measured in any of these units, but usually is expressed in Btu's. A Btu is the amount of heat required to raise the temperature of 1 pound of water by 1 degree Fahrenheit.

To exist, the average person must eat food amounting to about 4.4 million Btu's per year — the amount of energy contained in less than 340 pounds of coal. That is similar to the energy requirement of primeval man before he used fire. But civilization is based on increased consumption of energy.

If this same person drives a car 5,000 miles per year, an additional 45 million Btu's (equivalent to about 2 tons of coal) is required. In fact, the present-day reality is that all energy uses in the United States represent a per capita use of about 390 million Btu's (equivalent to 15 tons of coal) per year — almost a 90-fold increase over that used by primeval man. This has grown from 250 million Btu's per capita in 1960; it is expected to explode to 479 million Btu's by 1985, according to a 1972 study by the U.S. Department of the Interior.

With his 390 million Btu's it is obvious that the average American citizen is the greatest consumer of energy in the world. By contrast, his British counterpart consumes 170 million, a West German 140 million, and a Brazilian about 20 million Btu's annually.

In the U.S., if present trends

continue, a tremendous energy shortage could occur if American technology and knowhow fail to turn the tide and create new sources of energy.

The Office of Coal Research is proving that clean liquid and gaseous fuels can be manufactured from coal, the nation's most abundant fuel. Also, electricity can be generated from coal in an environmentally acceptable manner.

Ishpeming is Busy

Ishpeming, Mich., is a busy place these days.

Until now, this town of 8,800 people near the shore of Lake Superior on Michigan's Upper Peninsula has been best known locally for its ski tournaments, held annually since the 1880's. But Ishpeming also lies in the heart of the famed Marquette Iron Range, and it is that vital metal that is destined to give the town a new look.

Right now, one of the Nation's major iron producers is getting ready to open a new iron mine near Ishpeming. Soon there will be a new production plant as well, a plant that will convert ore from the mine into pellets, turning out a high-quality blast-furnace feed at the rate of 4 million tons a year. Almost \$200 million in capital is being invested in the new mine and plant which, besides establishing a new source of iron for America, will provide permanent jobs for 550 people and an annual payroll of roughly \$6 million.

A year ago it couldn't have happened. A year ago the valuable "ore" that will soon be mined and processed at Ishpeming was just so much waste rock. A year ago the end seemed to be in sight for the great iron ranges of the Upper Midwest, the Marquette and the Mesabi, which together had supplied the bulk of the Nation's iron needs for nearly half a century.

Eastern Minnesota and northern Michigan have been the Nation's main iron sources for a long time. Once, high-quality iron ore was shipped from both ranges directly to the great steelmaking cities. Later, as

ores of the desired "direct-shipping" quality started playing out, lower grade ores from both iron ranges were enriched to make blast furnace feed in pellet form.

But the enrichment process depended on the magnetic properties of the iron mineral, and vast tonnages containing nonmagnetic iron minerals lay untouched and worthless. In the standard ore treatment technique, iron particles were separated from waste in the magnetic ore by grinding the material fine and passing it close to powerful magnets, which attracted only the valuable part. Unfortunately, the standard technique was of no help in dealing with the nonmagnetic ore.

Although the ore at Ishpeming is 36 percent iron, the iron is not magnetic. It would still be worthless today — except that metallurgists of the Interior Department's Bureau of Mines have shown how to upgrade it to a commercially valuable concentrate, by a specialized adaptation of standard mineral technology. Moreover, the Bureau-developed process can be used on millions of tons of similar iron-bearing material in other parts of the region. And the same process could be adapted for use on several billion tons of low-grade iron ore in the Mesabi Iron Range of Minnesota.

Bureau researchers started working on the problem in the late 1950's. They hoped they could find a way to use an ore concentrating technique which had been invented at the turn of the century, and which had become the 20th century's most important development in the science of separating valuable minerals from the useless materials with which they occur in their deposits in the earth.

That revolutionary technique is "froth flotation." In using this method finely powered ore is mixed with water and special chemicals that will foam when agitated. Air is introduced into the swirling mixture and a light, foamy layer forms on the surface. The valuable minerals attach themselves to the air bubbles that collect at the top of the unit, where they are captured by skimming them off continuously. Wastes are collected at the bottom of the unit. Or the process can be reversed, as needed, so that the waste particles rise and the valuable ones are collected below. Usually the valuable concentrate from one cell must be processed again in others, until the resulting flotation product has the purity or other quality that is needed.

The Bureau worked painstakingly

to find the right combination of chemicals and conditions to make flotation succeed on the low-grade nonmagnetic iron ore. The major problem was that, when the ore was ground finely enough to liberate most of the iron mineral, too much iron was rejected with the waste.

Finally, after a dozen years' work, a commercially usable process was developed. A way had been found to cause particles of iron in the pulpy mixture to clump together, so that much of the slimy waste could be separated and removed before flotation. Then, during the actual flotation stages, the remaining wastes could be successfully floated and skimmed off without excessive iron losses.

Perseverance paid off, and the Bureau's experiments ultimately led to success. The process worked. To protect it for public use, the Interior Department obtained a U.S. patent in behalf of the public. In the challenging work of transforming an abundant, "useless" mineral to a valuable source of iron, diligent research proved to be the key.

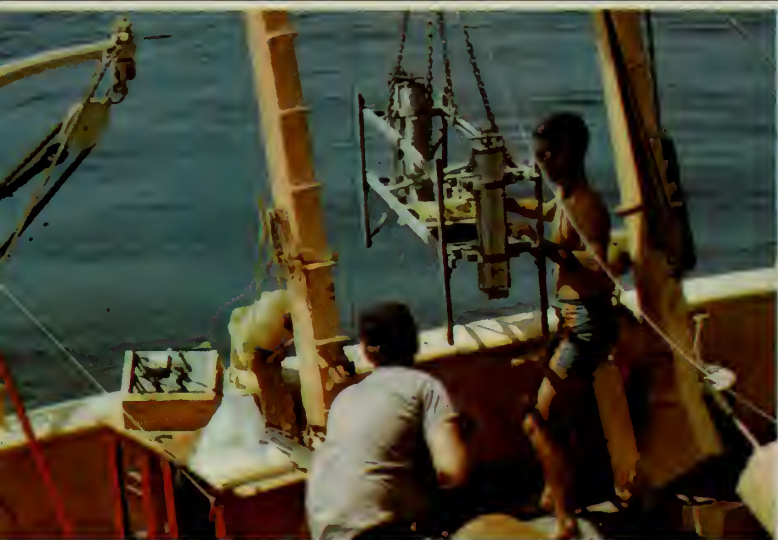


(Top) Technicians adjust flotation cells used in Bureau of Mines research on upgrading nonmagnetic iron ore.

(Middle) Chemicals are used to make the valuable particles in the crushed ore clump together. Waste materials are removed by "desliming."

(Left Bottom) Nonmagnetic taconite iron ore, being prepared for metallurgical experiments, was considered useless until the Department's Bureau of Mines developed a practical technique for converting it to high-grade iron ore concentrates. Billions of tons of taconite are found in Michigan and Minnesota. (Right Bottom) Waste minerals are removed in the froth overflowing the flotation cell, and the iron-rich concentrate is collected from below.





Looking like a mini-torpedo, a side scanning radar head (Top) is just one of many new tools being used by Geological Survey marine geologists as they map the topography and structure of the ocean bottom. Core samples of bottom sediments and rocks (Middle and Bottom) give the geologists a direct "bird-in-hand" view of the mineral and fossil makeup of the ocean bottom. Even more direct, geologists don scuba gear (Right Middle) to look over the surface of the ocean floor for tell-tale clues that may unlock the structure and potential mineral wealth of our ocean frontiers.



Probing the Seafloor

The energy challenge, rapid growth of coastal communities and recreational areas, and increasing public concern about the environment have brought sudden widespread attention to the uses and resources of the seafloor.

Much of this attention stems from past success and promises of further success in the exploration and discovery of oil fields beneath the continental shelves, and from fears that accidents among these successes may lead to irreparable damage to the marine environment. Proposals for mining sand and gravel from surfaces of the continental shelves, for dumping increasing amounts of wastes on the seafloor, and for constructing offshore airfields, power-plant sites, and facilities to receive large oil tankers disturb those who make their living or derive enjoyment from fishing, sunbathing and swimming at beaches and those who wish to bequeath a rich and healthy environment to future generations.

To completely reconcile and satisfy all needs, interests, and concerns relating to development of seafloor resources would be a monumental, if not an impossible, task. Proper planning and sound, timely decisions concerning seafloor development, however, will provide the fullest measures possible in achieving an acceptable balance between environmental and resource needs. Knowledge and understanding of all aspects of the seafloor and the marine environments, including their resources and hazards, are the keystones in achieving such a balance.

Because the Nation has a critical need for new sources of oil and gas, attention is now focused on portions of the Nation's continental shelves that appear promising for petroleum discoveries. These areas are widely scattered along the Nation's coasts from beneath the warm waters off Florida and in the Gulf of Mexico to the frigid Arctic off the north coast of Alaska. Ship-borne U.S. Geological Survey scientists study these areas throughout the year, although during the bitter winters off Alaska most of the scientists working there return to their offices and laboratories elsewhere

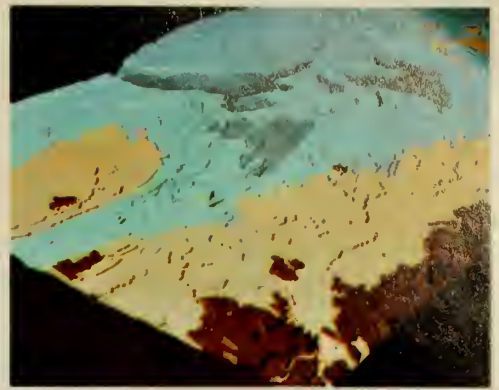
to study the samples and data that they have collected.

Survey scientists—geologists, geochemists, and geophysicists—do not search specifically for deposits of oil and gas or minerals, although much of the information that they collect is helpful to the extractive industry. Instead, they study features of the seafloor, properties of the sediments and rocks, and conditions that may prove hazardous to future seafloor use and development, such as foundation conditions that might become unstable and either settle or slide during an earthquake.

The Survey marine scientists do most of their field work aboard ships belonging to other agencies and institutions through both cooperative and contract arrangements. Aboard the larger ocean-going research vessels, work goes on around the clock from the time the ship leaves port until it returns. The Survey's own fleet is limited to one small ship and several launches that are safe to operate only in protected waters such as those of San Francisco Bay.

Although most of the research vessels have instruments and tools to probe the seafloor, the Survey's marine scientists must still use their own specialized equipment. Among the most useful specialized tool is a seismic system that generates sound waves which travel downward and into the seafloor where some of the sound waves are reflected upward and back to the ship by sediment layers on the seafloor. When seismic systems were first developed, dynamite was used to generate the sound. Today, Survey scientists use a contained electric spark as sound source which may startle fish, but doesn't harm them.

Because they must travel a greater distance, the sound waves reflected from the deeper sediment layers arrive at the ship after those from the bottom and shallow layers. As the ship travels along, records of the waves from repeated sparks begin to form a kind of "x-ray" picture of the bottom and the layers below. To the scientists, watching these pictures grow can become fascinating, especially if the layers are bent, broken, or begin and end abruptly. They may enthusiastically glue themselves to the recorder "tube" long after their shift, possibly asking the captain to change course so more can be learned about some feature that has appeared. Most captains have learned to be tolerant with these scientists, and if at all possible will



Far from being smooth, a model of part of the Atlantic Outer Continental Shelf (Top) shows the rough features that make more difficult the job of mapping the surface and underlying geology of the ocean floor. Core samples of the bottom sediments (Middle) are collected aboard special "floating laboratories" where Geological Survey geologists can make immediate examinations (Bottom) and zero in on sites that are of particular geological interest.

oblige them by changing the course.

There are several types of seismic exploration systems. Some, used by industry in its search for new petroleum fields, produce sound waves that penetrate to layers far below the surface where oil and gas structures may be found. Survey scientists use systems that give clear pictures of surface layers and condition, and together with samples and other data, these systems are used to identify

seafloor hazards and other phenomena that bear on the exploration and development of promising deposits.

These and other instruments and tools, including the use of closed-circuit TV, have built-in elements of suspense and surprise for the specialists. A sudden, unexpected jump in numbers coming from an instrument that is measuring magnetic properties of the rocks and sediments on the bottom may result in an urgent call to the captain to change station.

Following their return to port, Survey scientists return to their laboratories with their bounties of new data and samples to process and analyze them and report their findings. Even now, the elements of suspense and surprise remain: a correction brings to light a jump in numbers that was not recognized aboard the ship; a laboratory specialist may distinguish some significant but subtle property of the samples that becomes evident only with the use of sophisticated laboratory instruments; or plotted values may show an insufficiency of data. Once again the scientists may call the captain, but this time to arrange for a new cruise.

Some of the subjects that excite Survey scientists may seem to have little immediate relevance to the needs of the planners and decision-makers, and yet the results of their efforts may be of paramount importance. For example, one Survey geochemist derives satisfaction in squeezing samples and determining the salt content of the water that he obtains. Little blips and wiggles on his plotted curves have been used to identify the location of nearby hazards and mineral deposits overlooked during other studies.

Although Survey scientists are not searching for mineral deposits, the chances of finding them exist from the time the ships leave port until the final maps and reports are completed. Several deposits of sand and gravel have been located and have become targets of further, more detailed industry studies. Many areas that warrant exploration for oil and gas and various metals are indicated on the maps and in the reports resulting from the Survey's efforts. The main value of the Survey's seafloor investigations, however, lies in the information that they provide about the environment—the answers to many of the questions that the planners and decision-makers ask or should ask.

Refilling the Horn of Plenty

Energy-wise, the horn of plenty is running lower.

Because our cornucopia of popular fuel sources has been dwindling, the nation's vast coal reserves—long suffering from a lack of public attention—is cleaning up its dirty image to win a new role in the production of energy.

How do you convert coal into a cleaner-burning fuel?

Essentially, conventional cleaning methods involve specific gravity separation inside a vessel containing a liquid. The pollutants—ash and sulfur-bearing materials—sink to the bottom of the liquid and the lighter weight coal material is skimmed or floated off at the top.

Meanwhile, the development of cleaner uses for coal is moving into more advanced stages with the potential for such technology to reach the commercial market by 1980.

In deriving clean forms of gaseous, liquid, and solid fuels from abundant coal reserves in the United States, these scientific techniques will not only help close the energy gap and lessen the danger of pollution; they will create jobs and perk up segments of the national economy.

For translation into more specific terms, consider any rural area of the U.S. where there are large coal deposits and substantial supplies of water. Into this area moves a coal-processing complex requiring an investment in mine and physical plant of \$450 million. Construction may take three or four years, providing as many as 5,000 local jobs at its peak.

As building tapers off and operations begin, the complex would mean steady employment for 1,500 to 2,000 persons. Each worker would require additional goods and services, thereby creating still more new jobs and opportunities for investment.

Such is the prospect currently envisioned for the production of clean and inexpensive energy from domestic coal. The whole concept makes use of the fact that coal can be fractionated, or refined, so that separate portions of it are converted to synthetic gas, to liquid fuel, to electric power, and to solid reformed coal.

Several phases of the coal-to-gas

program are sponsored jointly by the Office of Coal Research (OCR) and the American Gas Association (AGA) and will run for 4 years (1971-75). The total cost will amount to \$120 million, with AGA's share coming to \$40 million.

Under the cost-sharing program, a variety of processes is now being advanced to the pilot plant stage—midway point toward commercial plants for the general public. Two of the plants were being placed into operation in Chicago, Ill., and Rapid City, S. Dak. By 1975, a third coal-to-gas pilot plant—now under construction near Homer City, Pa.—will begin processing 5 tons of coal per hour to produce 100,000 cubic feet of clean pipeline quality gas per hour. These facilities are expected to provide data necessary for the design of commercial scale gasification plants that could use 16,000 tons of coal to produce 250 million cubic feet of pipeline gas daily. This would supply the gas needs for a city of one-half million persons.

In addition, ground has been broken for a solvent refined coal multi-purpose clean-energy pilot plant at Tacoma, Wash., and a coal-to-clean liquid and gas pilot plant at Princeton, N.J., has completed its second successful year of operation under project COED (Char-Oil-Energy-Development).

Extracting synthetic gas from coal is not exactly new. In early World War II days most gas being used in the U.S. was produced from coal, but it was expensive to make, distribute, and store—and was dirty.

By contrast, present-day gasification methods produce a quality of gas with the clean characteristics of natural gas. While their economics are yet to be proven out, coal-to-gas processes do remove such pollutants as sulfur and particulate matter, prime offenders to the environment when coal is burned directly as a fuel for electric power generation and in industrial processes.

Gasification technology evolved as a priority item because the demand for natural gas in the U.S. is growing faster than for any other fuel, increasing almost 30-fold in the past 50 years. Today, natural gas supplies a third of the nation's energy needs, with annual requirements expected to double in the next 20 years. In recent years, the demand for natural gas has greatly exceeded supply, leading to a serious shortage and thereby pushing coal to the forefront in the search for practical solutions to the "energy crisis."

The U.S. is not likely to run short of coal for 500 years or so. Conservatively estimated, the remaining reserves of coal total about 1½ trillion tons based on 50 per cent recovery at depths of less than 3,000 feet. About 3/5 of these reserves lie west of the Mississippi River, mostly on public lands. Even though coal represents 78 per cent of total fossil fuel reserves of the U.S., coal production is less than 20 per cent of the annual national output of fossil fuels.

The new coal-to-gas technology, expected in commercial plants within about 7 years, would stimulate the production of coal and reflect a more balanced picture in supply and demand.

Clean Gas from Coal

The first step in converting coal to pipeline gas is the production of a raw gas with a heat content of about 400 Btu per cubic foot, which must be cleaned and upgraded to pipeline-quality gas of 900-plus Btu per cubic foot. This gas is then chemically similar to natural gas and can be mixed with or used instead of natural gas.

A typical coal-to-gas commercial plant would cover almost 1,000 acres. The main complex would include coal and ash-handling facilities, multiple gasifiers, crude gas shift converters, purification plants, methanators, compressors, dehydrators, a gas-fired boiler plant and power generation, and supporting facilities.

When first entering a complex, coal must be screened and conveyed into gasifiers, which operate at temperatures up to 2,000 degrees F. There, in a pressurized, sealed system it is reacted with oxygen and steam to produce the synthesis gases (mixtures of carbon monoxide and hydrogen). Compounds such as sulfur and carbon dioxide are removed and then the synthesis gas is

converted into methane, the main constituent of synthetic natural gas.

The plant processing the necessary large quantities of coal will be designed, engineered, and built in the United States. The coal itself will be mined by U.S. labor using U.S. machinery and materials; the coal will be delivered — not in Algerian owned cryogenic tankers — but in American railroad cars or barges.

Thus, for every dollar's worth of energy produced from government-industry research, the U.S. would have an internal monetary balance — not an external imbalance.

A major consideration in choosing a suitable location for a coal gasification plant is the dependability of a long-term supply of water. For instance, a plant producing 250 million feet of pipeline quality gas would require 10,000 acre feet of water per year. Such plants will treat discharged water through a system that totally recycles the water, thereby eliminating discharge and reducing intake requirements.

Significantly affecting the cost of gas in the synthetic processing is the price of coal, which will generally account for about 40-60 per cent of the total cost. Plant investment is also costly. Fortunately, however, the price range of synthetic gas is expected to be competitive with other long-range alternatives such as gas brought by pipeline from Alaska, or imported as a liquid in specially-designed tankers across thousands of miles of ocean.

Since being authorized by Congress in 1960, the Office of Coal Research — working with private industry — has been developing processes that will use large quantities of coal to provide low-sulfur gas and oil fuels and thus meet the rising standards of pollution controls.

OCR projects for coal-to-electricity conversion offer clean methods based on the use of considerably less coal per kilowatt hour generated. The projected conversion rates of 50 to 60 per cent compare with a present ratio of 40 per cent for the best conventional boiler-generated plants.

Starting from zero, a typical time schedule for coal research and development calls for approximately 10 years to run the course of required stages — bench scale research, process development unit to improve necessary techniques, and the pilot plant and demonstration plant phases to develop the engineering and cost data needed for scale-up toward a commercial plant.

Volcano Helps Geothermal Search

New Mexico Highway 4 climbs westward from the sun-flooded valley of the Rio Grande in northern New Mexico to an elevation of 9,500 feet among blue-green pines in the Sierra De Los Valles, and then drops abruptly into the broad, open grasslands of Valle Grande.

Although not a well-traveled road because of its remoteness, scientists of the U.S. Geological Survey have traversed the highway numerous times in the 25 years that they have worked in the Jemez Mountains. These scientists are volcanologists who have been systematically unraveling the geological secrets of the Valles caldera, a complex depression, some 10 miles in diameter, an inactive but geologically young volcano that flanks the Rio Grande northwest of Santa Fe. Largely on the basis of this careful mapping, the Union Oil Company is exploring and developing a geothermal steam field in an area called Redondo Border in the very heart of the caldera.

To the uninitiated, the Valles caldera doesn't fit the classic picture one usually associates with volcano-barren, lava-covered slopes, match-stick forests felled by fiery avalanches or noxious fumes, and belching of smoke or plumes of steam high in the atmosphere. Actually these phenomena are episodes of Valles caldera's past. Today, the benign volcano is mantled by forests and meadows. The Valle Grande and Valle San Antonio are coursed by sparkling streams of cool, clear water. Cattle graze the banks. How, then, does it

Valle Grande, N.M.



happen that geothermal steam has been tapped here?

The secret lies in the history of the volcano. The Geological Survey recognized, prior to World War II, that the Jemez Mountains constituted an ancient volcanic field. Preliminary geologic mapping and sampling further revealed that the youngest episodes of eruption were in the not-too-distant geologic past.

Despite recent volcanic activity, the youngest deposits have been incised by stream erosion, and critical cross-sections of many of its deposits are exposed for study. It was thus seen by Survey geologists as an ideal place for intensive investigations of the workings of a volcano— young enough to retain evidence of almost all its phenomena of activity, but safe from a standpoint of physical hazards. It was ultimately discovered, after painstaking study in the field and laboratory, that the volcano was still cooling off. Rocks of very high temperature still resided deep in its core.

Some of the conclusions reached as a result of the studies by the Survey scientists have changed the science of volcanology. Their investigations are now having a major impact in the development of geothermal energy—a promising new source of power—in the United States. What began as pure research in the esoteric field of igneous petrology has found practical application in a national program of geothermal energy exploration.

Better Air for Miners

A frosty morning in the West Virginia mountains. A group of men wait at the mouth of a coal mine tunnel that pierces the mountainside. They are dressed like coal miners have dressed for generations—in protective helmets with cap lamps, in coveralls, carrying lunch buckets in their hands. One miner, however, is adjusting an unusual-looking device on his belt. It is a small box from which emerges a plastic hose that runs up to his chest, where it is clipped to his coveralls.

The device is a dust sampler. A tiny pump in the box sucks air continuously through the tube, and a filter traps the dust particles as small as 1/25,000th of an inch. Coal miners used to breathe a lot of dust like this, and it gave thousands of them a disease called black lung.

Until recently, only miners were much concerned about the ravages of black lung, which may afflict as many as one-fifth of the active and retired coal miners in America. In 1969, however, the Federal Coal Mine Health and Safety Act set the first limits to respirable coal mine dust—the particles small enough to enter the terminal passages of the lung, where the damage is done.

Although achieving the low dust limits specified in law seemed a difficult technological challenge, the Bureau of Mines was able to prove that it could be done. Bureau experts realized that respirable dust particles are so small that, in air, they behave just like a gas—just like the methane gas, for example, that coal sometimes gives off when it is cut. Methane is explosive, and there is a well-developed ventilation technology for diluting it to harmless levels, and moving it out of the mine. Couldn't ventilation technology be adapted to the dust problem, the Bureau wondered? Yes, it could.

At the West Virginia mine, the "man-trip" arrives. It is an electrically-driven car only two feet high, designed to operate in "low coal." The men climb in, lying almost prone beneath the protective steel top. After a ten-minute trip, they climb out again at the mine "face," where the coal is cut. A strong breeze ripples their clothes. Some of the men have objected to the stronger ventilating currents, but they all know, too, that this is the air that protects them from methane and black lung. Some of them begin to adjust the auxiliary fans that scour the face with even stronger air currents, to capture the coal dust where it originates, and sweep it away from the men. The miner wearing the dust sampler moves a cutting machine into place, and the day's work begins.

There is no cure for black lung. Once a man suffers lung damage from coal





(Left) Tom Wilkinson jumps from the rescue capsule that brought him out of the depths of the Sunshine mine. Wilkinson and his partner were trapped underground for a week after a fire broke out in the Idaho silver mine in May, 1972. They were rescued by Bureau of Mines men who rode the two-man capsule down a ventilation borehole to find them. (Top) A coal miner wears a respirable dust sampler that continuously sucks in a small quantity of air from his breathing zone; the hose is connected to a battery-operated pump clipped to the belt. A filter removes dust particles in the size range that can cause black lung. (Middle) In a surgically clean Bureau of Mines laboratory, respirable dust filters are removed from their mailing containers with tweezers, to prevent oil on the finger tips from adding to the weight of the dust on the filter.

dust, it cannot be reversed. Prevention is the only recourse, and ventilation the best method. The Bureau of Mines had to come up with a practical system of enforcing the dust limits to ensure that every operator was conscientiously protecting his men.

The personal dust sampler proved to be half the answer; the computer the other half. The Bureau devised a complicated system requiring, in effect, that a representative number of men in each mine carry dust samplers at intervals short enough to provide a continuous flow of reliable samples from the mine air. The samples are mailed to a Pittsburgh, Pa., laboratory

where their dust content is measured. The data is transmitted to the Bureau's Denver, Colo., computer, which maintains a running check on the air in every coal mine. If a newly-arrived sample shows that the dust levels in a given mine have suddenly risen beyond legal limits, the computer prints out a violation notice immediately. Bureau mine inspectors contact the operator to see that dust levels are reduced.

How well does the system work? Two kinds of answers can be given. First, it is an outstanding success in terms of dust reduction. Almost all mine operators successfully reduced their dust levels to the legal limits when the law took effect in 1970. This was determined by analysis of the samples sent in by the operators, but the Bureau double-checks by taking its own samples from time to time and the results were confirmed: Dust levels were down dramatically. So dramatically, in fact, that most operators had little difficulty meeting an even lower limit that took effect at the end of 1972.

In terms of preventing black lung entirely, however, the answer cannot yet be given in such unequivocal terms. This is because nobody today knows exactly how low dust levels must be to prevent the disease. Most experts think the limit now in effect—two milligrams of respirable dust per cubic meter of air—will eliminate black lung. If this is true, we may not know it for several years—the time it takes for a case of black lung to develop. If time or research prove, however, that the two-milligram limit is still too high, the law gives the Government the authority to reduce it further—by as much as may be necessary.

One thing is sure. Many cases of black lung, if not all of them, have been prevented by the Federal limits. The man who runs the cutting machine in the West Virginia mine can literally breathe easier because of the Bureau's success in enforcing these limits. So can all his fellow-miners everywhere.

The shift is over in that mine; the men return to the surface on the man-trip and head for the building where they will change their clothes. The cutting-machine operator stops first at an office where he takes off the sampler, and hands it to the man in charge of dust control. The sample will soon be in the mail to the Bureau. It is unimpressive in appearance; a two-inch ring of white plastic supporting a mesh filter that traps the dust. But it carries a message of life for all coal miners.



"Subsidence" is the sinking of the land surface over abandoned mines which have caved in. (Top Left) In Scranton, Pa., a subsidence-damaged house has been tilted on its foundations. (Left Middle) Material from this coal-mine waste pile in Scranton, Pa., is being crushed and pumped underground in a Bureau of Mines experiment to test a new way of preventing subsidence over abandoned mines. (Left Bottom) In earlier mine backfill work, trucks dumped the backfill material into hoppers like this one, which sits over an open borehole leading underground. Men with hoses wash the material into the hole. (Right Top) Marks of subsidence—dislocated foundations, cracked concrete. (Right Middle) "Sinkhole" subsidence affects only a small area, but can happen quickly. (Right Top, Page 47) Emergency repairs on a subsidence-damaged street.

Subsidence in Scranton

Scranton, Pennsylvania, is a city scarred by prosperity. Located in the heart of the anthracite region, it boomed about half a century ago when anthracite was a premier fuel. The city lies directly over some of the old mines, mines no longer being worked in an age when anthracite is barely competitive. Because the mines are abandoned, underground maintenance has ceased. Below the surface, 100 feet and deeper, the coal pillars are crumbling away. As they crumble, the mine roofs fall in, and the rock above gradually works its way downward. On the surface, the land slumps. Buildings crack. Potholes appear suddenly, without warning. Sometimes whole streets sink. This is called subsidence, and the anthracite region suffers from it as from a disease.

"My husband spends all his time from work repairing the house," says a Scranton woman. "No sooner does he fill one crack than the house shifts again."

There is only one way to prevent subsidence in Scranton and the rest of the anthracite region—fill in the underground voids before subsidence begins. Until recently, there were only two ways to "backfill" these voids. If you could get into the old workings, you ran pipes and hoses underground, and pumped in the fill, mixed with water. Underground workers would direct the "slurry" into all mine openings. When the water drained away, the fill material was packed into the voids. Support is excellent with this system.

Unfortunately, this kind of "controlled flushing" can't be used in most cases. Many of the old mines are flooded, or too dangerous for men to enter. In

such cases, you fall back on "blind flushing." You drill holes from the surface into the old mines, and flush the fill down the holes with water. It takes a lot of holes. And most of them have to be drilled on public land, like streets, because of the legal problems involved in drilling on privately-owned land, and the expense of repairing property where trucks and heavy equipment have operated. Unfortunately, you cannot fill all the underground voids this way—the fill forms cone-shaped piles under each hole, and when the pile reaches the bottom of the hole no more goes in.

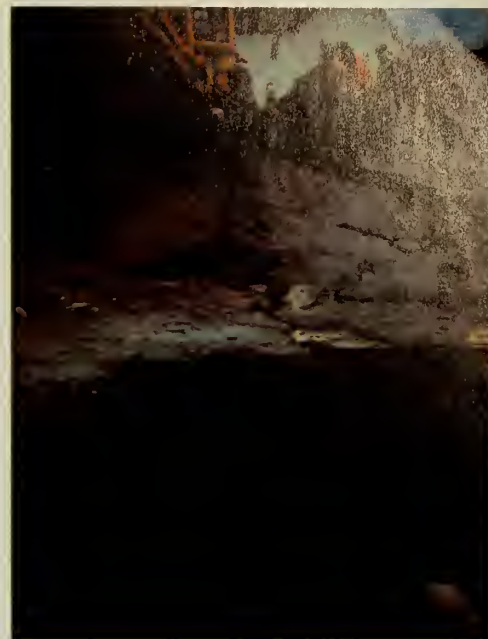
"We were never satisfied with blind flushing," says a Bureau of Mines engineer. The Bureau has been involved with these backfilling projects since they were first authorized by Congress in 1962. "You only provided some direct support under the streets and alleys," the engineer goes on. "By doing so, of course, this gave indirect support under adjoining properties. But not as much as we would have liked. We were never satisfied with it, no. But it was the best that we could do."

Last year, the Bureau began experimenting with something better. It is a pressure flushing method developed by the Dowell Division of the Dow Chemical Co. Dowell knew about the problems involved in pumping materials down drill-holes because of its involvement in the oil industry.

In the pressure method, the fill is mixed with water and pumped underground under pressure. As with blind flushing, a mound of fill begins to rise under the hole. Instead of being cone-shaped, however, it is like a doughnut, with the flow from the borehole keeping the center clear. As the mound grows and approaches the roof, the pressure rises, and the "slurry" forces new channels across the top. The mound begins to grow laterally. The fill spreads through the mine voids, seeking out new paths around obstructions, and ultimately providing support for large areas.

At least, this is how the system is supposed to work. This is how it *did* work, in the first field test, in Wyoming, where part of the town of Rock Springs was slowly sinking into abandoned mine workings. A 2.7-acre area was filled from one borehole, giving good support to the ground above. Conventional blind flushing would have required 80 boreholes to do the job.

But conditions in Rock Springs are not exactly like those in Pennsylvania's



anthracite region, 1600 miles east. For one thing, the workings under Rock Springs were flooded. Although flooding is common in the abandoned anthracite mines, it is not universal, and it remained questionable whether the pressure flushing system would fill dry voids. For another, the Rock Springs test used ordinary sand as fill, but in the anthracite region the most readily available fill is mine refuse, a rather coarse waste product composed mostly of slate. If this material had to be crushed as fine as sand before it could be used in pressure flushing, the cost might be too high.

Obviously, then, the system had to be tested in the anthracite area. After some deliberation, the Bureau of Mines and the Commonwealth of Pennsylvania chose the Green Ridge section of Scranton, a pleasant residential neighborhood where the houses sit comfortably in the middle of large lawns. Subsidence had never seriously troubled Green Ridge, but the potential was all too obvious. About 150 feet below the streets was the first of several abandoned mine levels, and what engineers know about subsidence made it clear that Green Ridge was endangered.

Two churches and 87 homes occupy the quiet, 20-acre neighborhood that became the focus of the test. Under Bureau of Mines guidance, Dowell engineers moved in equipment during the late summer of 1972. Because it was to be a test, 48 holes were drilled—five for injecting the fill and the rest spaced out around the injection holes to monitor the spread of the fill underground. If it had been a standard blind flushing project, several hundred holes would have been required.

On the northwestern edge of the neighborhood, a contractor drilled two water-supply holes into one of the flooded mines, and installed two deep-well pumps. These holes were located on the site of the neighborhood's most conspicuous landmark — the 123-foot-high Eureka mine waste bank. An eyesore for decades, the 500,000-cubic-yard bank became the source of the fill to be pumped underground. Equipment was set up to crush the waste into pieces no larger than a quarter of an inch. Also sited at the bank were the tank, for mixing the crushed refuse with water, and the slurry pumps.

The injection hole to be used first was on Monsey Avenue, five blocks from the Eureka bank. All five injection holes were connected to the pumps with steel pipe, laid in shallow trenches under the streets. A deep cut was made in the Eureka bank to run the pipes through, and even at that early stage the project began to make a difference to some of the people in Green Ridge. A lady living in the shadow of the bank was able to see the mountains on the other side for the first time in her life.

On October 19, 1972, the pumps began to spin and injection started through the Monsey Avenue hole, where one of the slurry pipes emerged briefly from the ground before connecting to the hole itself. If the project had been a conventional blind flushing operation, a metal hopper the size of a pickup truck would have been mounted on top of the hole. Trucks loaded with fill would be rumbling up, dumping their contents into the hopper where men with firehoses would flush it underground. At Monsey Avenue, however, there was almost nothing to see or hear.

It was vital, however, to know what was happening 200 feet down, in the flooded Clark coalbed. So every morning men trudged the circuit of the monitor holes, unscrewing the caps and lowering a weighted line to detect the presence of the fill. After a while they noticed that a friendly German shepherd was waiting for them every morning at the first hole. When they were almost through, he would walk to the next hole and lie down on the snow to wait for them there, and so on through the circuit.

As the year drew to a close, results were encouraging. So much so, in fact, that two changes were made in the test plan. First, injection into a dry coalbed through the second hole began

much sooner than had been planned. Another neighborhood, located over dry mine voids, was experiencing severe subsidence, and officials wanted to know if the new injection method might help. So the valves were turned to divert the flow of slurry into an injection hole which intersected a dry portion of the New County coalbed, about 160 feet down. About 40,000 tons of slurry was pumped in — enough to satisfy everyone that pressure flushing works as well in dry voids as in flooded voids. By the beginning of the new year, Federal and State engineers were exploring the possibility of pressure flushing into the mines below the damaged neighborhood, to arrest subsidence that had already begun.

The second change was made after several months of injection proved that the crushed waste was flowing through the system with no difficulty whatever. If the system will handle quarter-inch material, the engineers said, maybe it will handle half-inch material, and save on crushing costs. Plans were made to switch to the larger material early in 1973.

The final report on the Green Ridge experiment is not yet written; the experiment itself is technically not complete. In the minds of the engineers who direct it, however, the test is an outstanding success. Most of the area they wished to fill underground is already full, providing excellent support for the houses and streets above. Use of crushed mine refuse proved to be no problem, and there is even hope that crushing requirements can be reduced beyond everyone's expectations. The system offers a more effective, less expensive way to cope with the subsidence problem throughout the anthracite region.

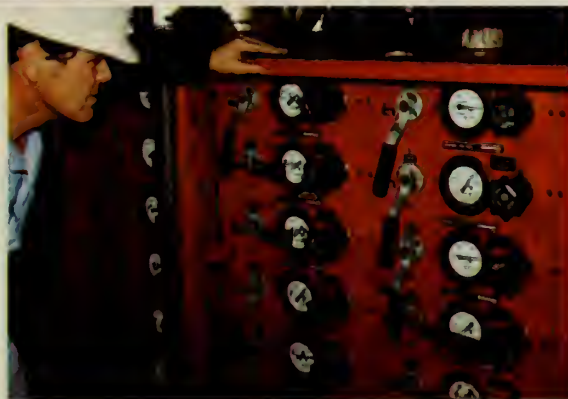
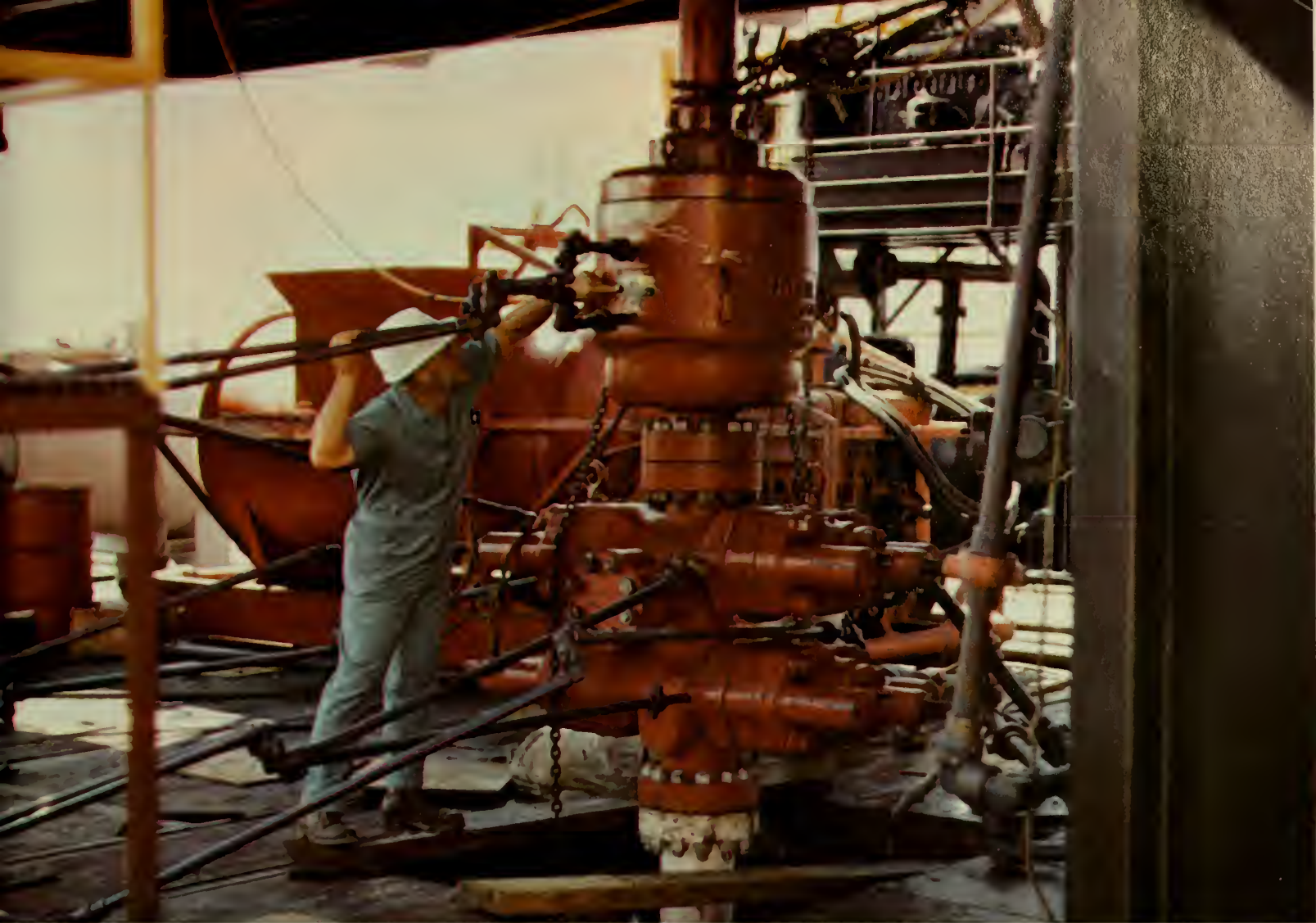
In the meantime, however, the experiment continues toward its official close, when the injection holes will be sealed and the equipment trucked away. The German shepherd continues to accompany the men who check the monitor holes every morning, and the lady who lives next to the Eureka bank has an even better view of the mountains. By the time the project is over, she will hardly be able to see the bank at all. Most of it will be back underground, where it came from. Hopefully, too, there will have been demonstrated a new and more efficient way to protect people and property against one of the major environmental hazards resulting from past mining operations.

Watching Offshore Operations

Early, each morning, U.S. Geological Survey helicopters fly over the Gulf of Mexico to ensure that the production of a major portion of the Nation's energy needs is accomplished safely and without damage to the environment. The men who ride in these copters are little-known, but important teams of inspectors (Petroleum Engineering Technicians), who fly surveillance and inspect Outer Continental Shelf (OCS) petroleum drilling and producing operations in the Gulf of Mexico. Their job is to insure that the oil companies who hold leases on the Shelf are operating in compliance with Federal Regulations and Orders which govern OCS oil operations.

The technician's typical day begins at dawn with the "commuter" flight to offshore fields. As the jet copter flies off, city life is rapidly left behind. The technician reviews his daily assignment, and scans the South Louisiana marshland below. Often duck, deer, alligator and other native wildlife can be seen. Gradually the marshland gives way to inland bays and estuaries where fish, shrimp and oysters abound. Beyond lies the Gulf, usually muddy near the coastline from sand and silt carried by the rivers and streams. Further out to sea lies the riptide where river meets the clear blue waters of the Gulf. As the helicopter crosses the coastline, the technician and his pilot don lightweight inflatable life jackets, and the day's work begins.

Approaching the nearest structures located in Federal waters, the technician scans the horizon for signs of any oil slick or oil pollution in the vicinity. In the event a slick is sighted, the pilot follows the path of the slick or spill to locate its source. If the



To insure that oil companies comply with Federal regulations in their quest for oil and gas in the Outer Continental Shelf, the U.S. Geological Survey has teams of technicians that watch over their operations. (Top) Checking a blowout preventer stack; (Middle) Observing the console controls on flowline sensors; (Bottom) Inspecting offshore oil rig equipment.

pollution originates from a production or drilling well located on a Federal lease, the pilot lands on the platform. The technician then contacts operating personnel and conducts an inspection to determine the cause of the oil spill. Often, an investigation reveals a spill is related to production equipment or safety device malfunction. Although many improvements have been realized as the results of improved equipment and extensive education and training of oil company personnel, minor oil pollution remains the most difficult problem. After accurately determining the facts, the lease operator is given a written citation for noncompliance with applicable OCS orders and regulations. The wells and equipment contributing to the pollution are shut in until all repairs and corrections are made, and a reinspection is performed.

In most instances, pollution monitoring flights are conducted only during trips to and from the field and during flights from one platform location to another. The technician's primary assignment is the detailed inspection of one or more of about 2,000 oil and gas producing and drilling platforms which dot the OCS in the Gulf offshore areas.

Usually the installation of a platform is preceded by exploratory drilling conducted by movable drilling rigs of the floating or "jack-up" type, used to define the extent of oil and gas bearing sands. After a platform is installed, a drilling rig is placed on the structure to drill and complete the remaining wells needed to recover the oil and gas reserves in the most economical and efficient manner. Finally, the drilling rig is removed, and full-time production operations begin.

The ultimate size of a production platform varies from a single oil or gas well to 50 or more producing zones. Equipment installed on the platform varies from a single wellhead to large, complex refinery-like facilities which include equipment for oil and gas production and separation, oil storage and metering, oil and gas transfer and sales, and gas dehydration and compression. The platforms also contain piping, valves, large pressurized oil, gas and water separation vessels, storage tanks, pumps, compressors, heaters, heat exchangers, scrubber vessels, pipelines and equipment for the removal of all traces of oil content from water and sand produced with the oil. In addition, all

platform equipment has various mechanical, pneumatic and electrical safety and anti-pollution devices and controls required by Federal regulations and orders. The technician's job is to inspect this equipment to see that it meets Federal safety and technical standards.

He arrives on location with a detailed inspection form which serves as a check list to insure that all required safety devices and equipment are present and that required operating practices are being followed. His test results are entered on the inspection form. The overall operation of each production and drilling facility is also examined during each inspection to verify that the various equipment and components are interconnected and operated as a unit to insure a safe and pollution free operation.

At the completion of each inspection, the operator is cited for any incidents of noncompliance, and any appropriate warning or shut-in action is taken. Before citing the operator, the assistance of Geological Survey engineering personnel is given in resolving all matters of a controversial nature. Lease operators sometimes disagree with the corrective measures required; however, over the years, USGS technicians have justly earned the reputation as being "tough but fair" and command the respect of company personnel. Technicians frequently find that operating personnel appreciate safe, pleasant working and living conditions which exist as the result of Survey requirements and inspections. Various company managers also comment that they rely on Survey inspections to verify that their field personnel are conducting operations in a safe and workmanlike manner.

Although minor oil pollution is still not an unusual occurrence on the Shelf, it is often possible to fly surveillance for an entire day without sighting a spill or slick, and the frequency of major pollution, fires and explosions, as verified by statistics, has now been greatly reduced. Most of this improvement has come about in the past three years because of the extensive strengthening of the OCS Orders and the initiation of the present OCS lease management program.

At the end of a day it's time for the technician to board his chopper and wave farewell to oil field hands who are sometimes glad to see him come and are nearly always happy to see him go.

Removing Sulfur Dioxide

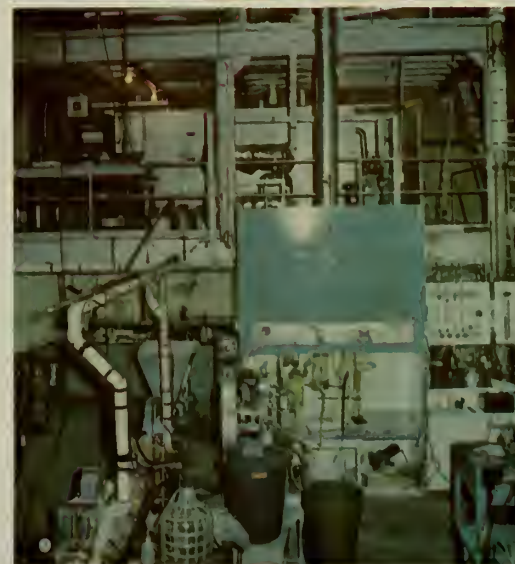
"I took the baby with me for a few minutes while I hung out some drapes to air," the young housewife said.

"When we went back inside, my daughter was coughing, and her eyes were watering. My throat was tickling, too. There's something irritating in the air, and somebody ought to do something about it."

The young mother was right. That irritating something was colorless sulfur dioxide gas. It comes mostly from the burning of coal and oil, and from metal smelters that process sulfur-bearing ores. Sulfur dioxide is one of our major pollution problems.

Sulfur itself is a valuable commodity. Recovering it from stack gases, therefore, would promote conservation, as well as pollution control. But even though some sulfur removal devices are in use, about 30 million

(Top) Sulfur—a valuable mineral in solid form; a noxious air pollutant in the form of sulfur dioxide. (Bottom) Laboratory apparatus used to demonstrate that the Bureau of Mines citrate process is capable of continuous operation.



tons of sulfur dioxide enter the atmosphere every year in the United States, representing 15 percent of all pollutants dumped into our air. This is largely because most stack gases contain less than one percent sulfur dioxide, an amount too small to recover by conventional means.

During the 1960's, the Nation began to count the human and environmental costs of pollution, and passed laws to clean its air, water, and land. As a result, pressure against polluting has been increasing, and stringent limits on the amount of sulfur dioxide allowed in the air will go into effect in 1975. These sulfur dioxide limits could be met by cutting back on the processing of minerals and use of mineral fuels. A better approach would be an inexpensive method to remove sulfur dioxide from the relatively dilute stack gases.

The Bureau of Mines has worked on the chemistry of smelting for many years, and has contributed to the current state-of-the-art in sulfur dioxide removal. It was natural, therefore, for Bureau metallurgists to join the search for a more effective, up-to-date method of removing this pollutant from smelter gas.

A team of scientists and engineers at the Bureau's Salt Lake City (Utah) Metallurgy Research Center was assigned the job in 1968. D'Arcy George, one of the Bureau's most experienced scientists in this field, headed the project. George and his associates had more than a professional interest in the success of the project. Both the Bureau research center and the homes of most of its employees are only a few miles from one of the largest copper smelters in the world. The Bureau team was well aware of the pollution from the smelter. They also knew that the smelter meant jobs for friends, taxes for the economy, and copper for the country. With both professional and citizen involvement, the effort would be well motivated.

The team's first task was a tedious one—to search all patent and technical literature on sulfur for clues that might help in developing a better emission control process. The search revealed a number of liquid organic compounds that would absorb sulfur dioxide from gas mixtures passed through them. Solid sulfur could then be formed by bubbling hydrogen sulfide through the absorber liquid. This seemed like an excellent approach—solid sulfur would be an ideal end product because it is a marketable commodity. If no market

were immediately available, it could be easily stored without endangering the environment. Also, some of the sulfur could be used to make the hydrogen sulfide needed in the process.

The problem now centered on finding the best organic absorber. The job was to require much testing. By the summer of 1969, after weeks of laboratory evaluation, D'Arcy George's team had established that a solution of citric acid and sodium citrate in water was one of the best for absorbing sulfur dioxide from simulated waste gas. Its capacity to absorb sulfur dioxide was good, its physical properties allowed it to be used again and again with very little loss, it was easy to work with, the sulfur precipitated from it was pure, and a plentiful supply of citric acid could be made by bacterial fermentation of molasses. Since no other anti-pollution system relied on citrates, the Bureau began to refer to its new technique as the "citrate process."

Disclosure of the successful laboratory work stirred wide interest in scientific circles during the fall and winter of 1969. But industry, pressed to reduce sulfur dioxide emissions by both Federal and local agencies, was reluctant to invest in unproven technology.

Bureau work to improve the various steps of the process continued without let-up, and by the fall of 1970, a copper producer was sufficiently interested to cooperate in testing the citrate process in a small pilot plant at its Arizona smelter.

The test had its share of the delays and equipment breakdowns that inevitably accompany a pilot plant operation. In addition, a lot of painstaking labor was involved in analyzing countless samples of gases and liquids at each of the various stages. The analytical section at the Salt Lake City center contributed greatly by developing new, accurate, fast procedures for identifying complex sulfur compounds. These new procedures cut the actual analysis time per sample from several hours to as little as 10 minutes. In addition, the analyses could be done at the Arizona site, saving days previously lost while the samples were in transit. In the end, the experiment was a success, showing that more than 90 percent of the sulfur dioxide could be removed from a smelter gas ordinarily vented to the atmosphere.

The test also provided engineering data needed for designing a larger plant, and gave preliminary cost

estimates for treating waste gases by the citrate process. Even without allowing any credit for sulfur that might be sold, the estimates were low enough to establish the process as one of the most promising for treating stack gas.

Research on ways to improve a process goes on continually. Progress is rarely spectacular, but once in a while a rapid advance results, sometimes in an unexpected way.

One such breakthrough in the citrate process came when a better way to collect precipitated sulfur from the citrate absorber was discovered. D'Arcy George's team was looking for a substance that, when added to the sulfur-citrate mixture, would lubricate the pump used to move this "slurry" to a centrifuge, where the solid sulfur particles are spun out of the liquid. Kerosene was tried, and within a minute the sulfur rose to the surface, leaving an almost pure citrate solution below. The elated team recognized this as a way to speed and simplify the sulfur collection process. A vacuum cleaner-like device was added to suck up the sulfur, and the centrifuge was eliminated entirely.

Some unexpected developments are never welcome. In 1972 the Bureau team was shocked by the death of its leader, D'Arcy George, the architect of the citrate process. Although his loss was a setback, his leadership had by that time brought the process to a point where outside interest was intensifying. Several manufacturers of anti-pollution equipment had studied the Bureau's process to aid them in developing systems of their own design. A chemical producer, an engineering firm, and a pollution control manufacturer joined in a venture to build a pilot plant to test their own version of the Bureau's process on stack gas from a power plant in Indiana. The Air Pollution Control Office of the Environmental Protection Agency had called the Bureau process one of the most promising for controlling dilute sulfur dioxide emissions.

The Bureau's effort continues under new leadership. A completely integrated citrate system is scheduled for pilot-plant testing at an Idaho smelter. Hopefully, in the not too distant future, the Bureau's sulfur dioxide research team can disband with the knowledge that it has made an important contribution to America's environment, and her ability to recover mineral resources as well.

Big View from Space

On July 23, 1972, a Thor-Delta rocket blasted off from a West Coast launching pad and boosted the Nation's first experimental Earth Resources Technology Satellite (ERTS-1) into a near-polar orbit around the earth at an altitude of about 560 miles.

The launch, directed by NASA, had been eagerly awaited by a host of scientists and engineers and resource managers working in a variety of disciplines, including, cartography, geography, hydrology, geology, oceanography, forestry, and agriculture. It was the first spacecraft designed to fit scientific needs, primarily, and was, indeed, designed according to specifications of scientists of the Department of the Interior and Agriculture.

The scope and magnitude of NASA's Earth Resources Survey Program involve a number of Federal as well as State and local governments, industry and universities.

The heartbeat of the program is the arrangement made by several Federal agencies to receive, assess, interpret, and distribute the stream of data returned from the satellite. Essentially, experimenters involved in the program are trying to determine how to apply this revolutionary method of obtaining resource and environmental data to the solution of burgeoning "down-to-earth" problems.

The most far-reaching of all agency programs aimed at making ERTS-1 data work for the benefit of man is the Department of the Interior's EROS (Earth Resources Observation Systems) program, administered by the U.S. Geological Survey.

Long before the launch of ERTS-1, Interior, particularly through the USGS, had been conducting extensive research in the application of aerial photography and satellite remote sensing techniques. The results of these studies provided solid feasibility support to the development of an ERTS satellite. EROS activities and scope have now been expanded to where nearly all of Interior's bureaus are involved.

Many of the earth's resources are finite. Demands of expanding technology and population have

placed huge drains on our resources. Matching these demands are long-term capabilities of the earth and effects on the environment. To seek solutions to long-term management of available resources and the protection of the environment, there is an urgent need to gather accurate and speedy information about the earth. Inevitably, this requires use of all science and technologies, including space technology; thus, the importance of ERTS and other systems of gathering and transmitting data by remote sensing techniques.

From its vantage point in space, passing over each point on the earth's surface once every 18 days, ERTS is making repetitive observations and measurements of our planet's dynamics that were heretofore impossible to obtain.

Who will use ERTS data? What are its direct applications, benefits and consequences?

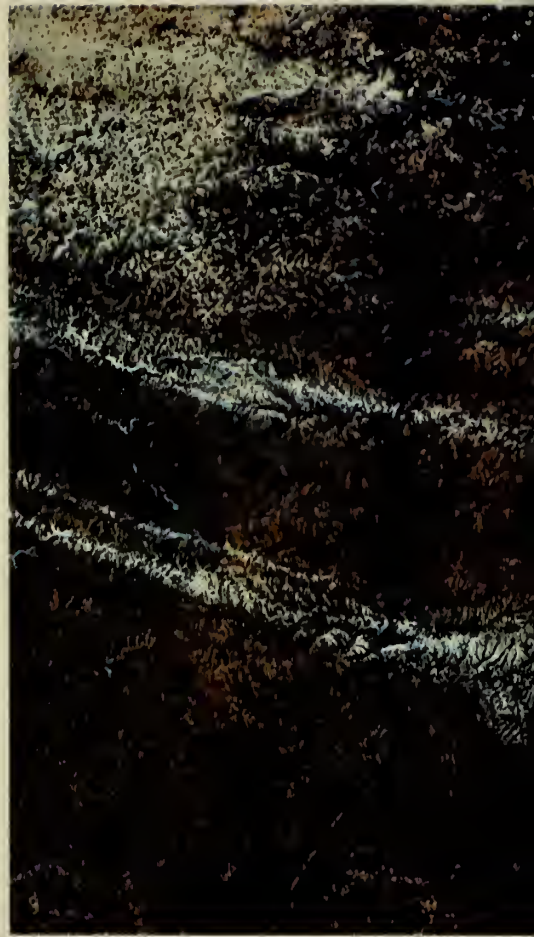
The direct users are scientists, resource managers and technicians who are analyzing the experimental data coming from the satellite. From this point on, interpretive methods can be applied and predictions can be made concerning the future. Ultimately, these efforts will benefit nearly everybody.

The application of ERTS (and other high-altitude) data can be highly valuable in the study of many major disciplines. Here are just a few examples:

Geology: ERTS data has revealed structures not seen previously, and not detectable by conventional montages of aerial photographs. Such data will increase our knowledge of mineral and fuel resources. Also, orbital observations will increase the potential for monitoring glaciers and volcanoes, and improve the possibilities of getting closer to predictions of volcanic eruptions, earthquakes, and landslides.

Hydrology: Fresh water is in limited supply in many parts of the world. Synoptic information that would be helpful to hydrologists include drainage patterns, distribution of snow and ice, soil temperature and moisture, and currents in lakes, reservoirs and rivers. Satellite data, also, should be a boon for flood control and management problems.

Geography: One of the most vexing problems facing the Nation is how to make the wisest use of our land and waters. By repetitive viewings of major urban areas, for example, geographers can obtain powerful "census" data that



(Top) View of the Wheeling, West Virginia, area as seen from 500 miles above the earth by the first earth Resources Technology Satellite (ERTS-1). The 13,000 square mile area (about 115 mi. x 115 mi. on a side) encompassed by this picture is imaged every 18 days, thereby giving earth scientists and resource managers a major new tool to understand and wisely use our Nation's finite natural resources. The variation in snowcover to elevation and to the track of the recent snowstorm can be clearly seen.

(Right) This ERTS image covers a portion of the Eastern Seaboard of the United States. New York City and the southwest tip of Long Island are in the upper right hand corner. Trenton appears near the center at the sharp bend in the Delaware River. The large city in the lower central portion is Philadelphia.

In this image, vegetation that is in vigorous growth appears red, clear water black, and water that carries silt appears blue. Likewise, the mixtures of asphalt, concrete and rooftops in the central cities appear grayish blue. Newer construction areas such as concrete highways, railroads, airfields, as yet unpaved shopping centers, or land clearing operations appear white, tan, or gray.



will show the many swift and complex changes occurring in land use patterns. The shifting patterns of change, involving the interaction of man and his surrounding environment can be plotted, and data given to help agencies and officials in their regional and local planning.

Agriculture: Multispectral imaging from ERTS can differentiate various crops and reveal their growth, vigor, and soil conditions. Blights and insect infestations can also be detected and mapped, and data on the surface area and depth of potholes will be gathered through this imagery.

These are just a few of the direct and indirect benefits to be gleaned from ERTS, EROS, and related programs, including the new sky lab missions. Hopefully, the knowledge will create new applications that will yield expanded benefits beyond those now envisioned.

In the final analysis, the capabilities of remote sensing from space will not eliminate the need for aerial observations and surface exploration. It is simply a capability—one which is being meshed with conventional methods as an enormous aid for finding out more about our environment. As expressed by the late Dr. William T. Pecora, former Director of the U.S. Geological Survey, and later, Under Secretary of the Interior Department:

"Satellite data will not solve all our mineral and land resource or environmental problems. There always will be need for a great variety of airborne activity, earthbound studies, and ground truth systems. We believe, however, that satellite systems will be powerful tools for use in continually inventorying and managing our national resources more effectively, and in helping us to be more effective in preventing degradation of the environment. The broader perspective and rapid coverage available through this technology are essential for filling the quantitative and qualitative gaps in understanding. Remote sensing from space has already demonstrated its value in many ways."

The establishment of the EROS Data Center at Sioux Falls, S.D., is bringing the products of ERTS-1 and other high altitude data directly to the public at large. People who use the Center are as varied as their interests. Inquiries come from large oil companies requiring imagery of areas throughout the world. Cartographic specialists want data to make new accurate maps. Planning agencies want to up-

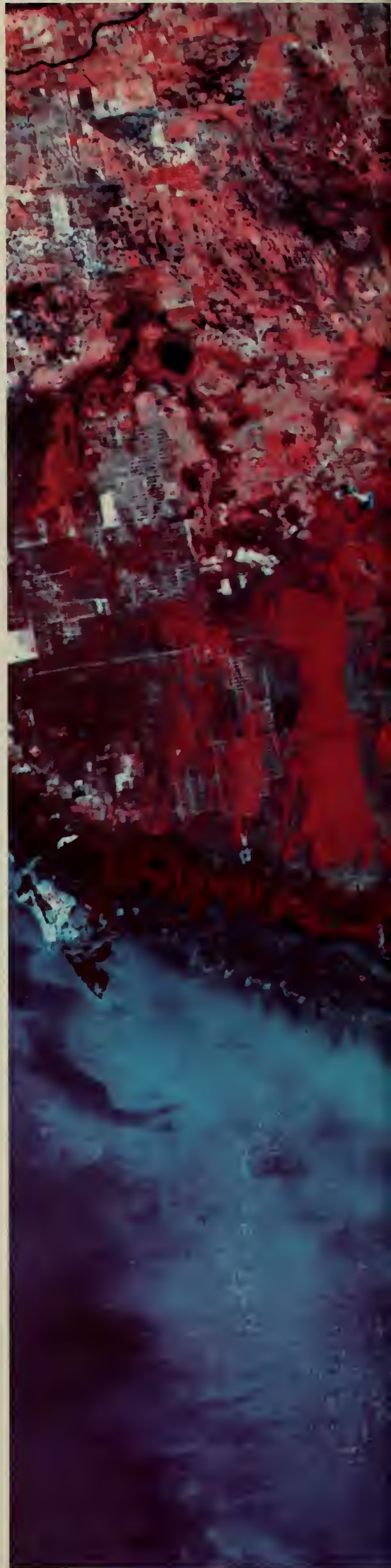
(Right) Image of south Florida from NASA Earth Resources Technology Satellite. Water management agencies are using it to delineate surface water patterns and water distribution within the Everglades and the Big Cypress Swamp. Biologists are using it to determine better management practices to maintain the Everglades and the Big Cypress.

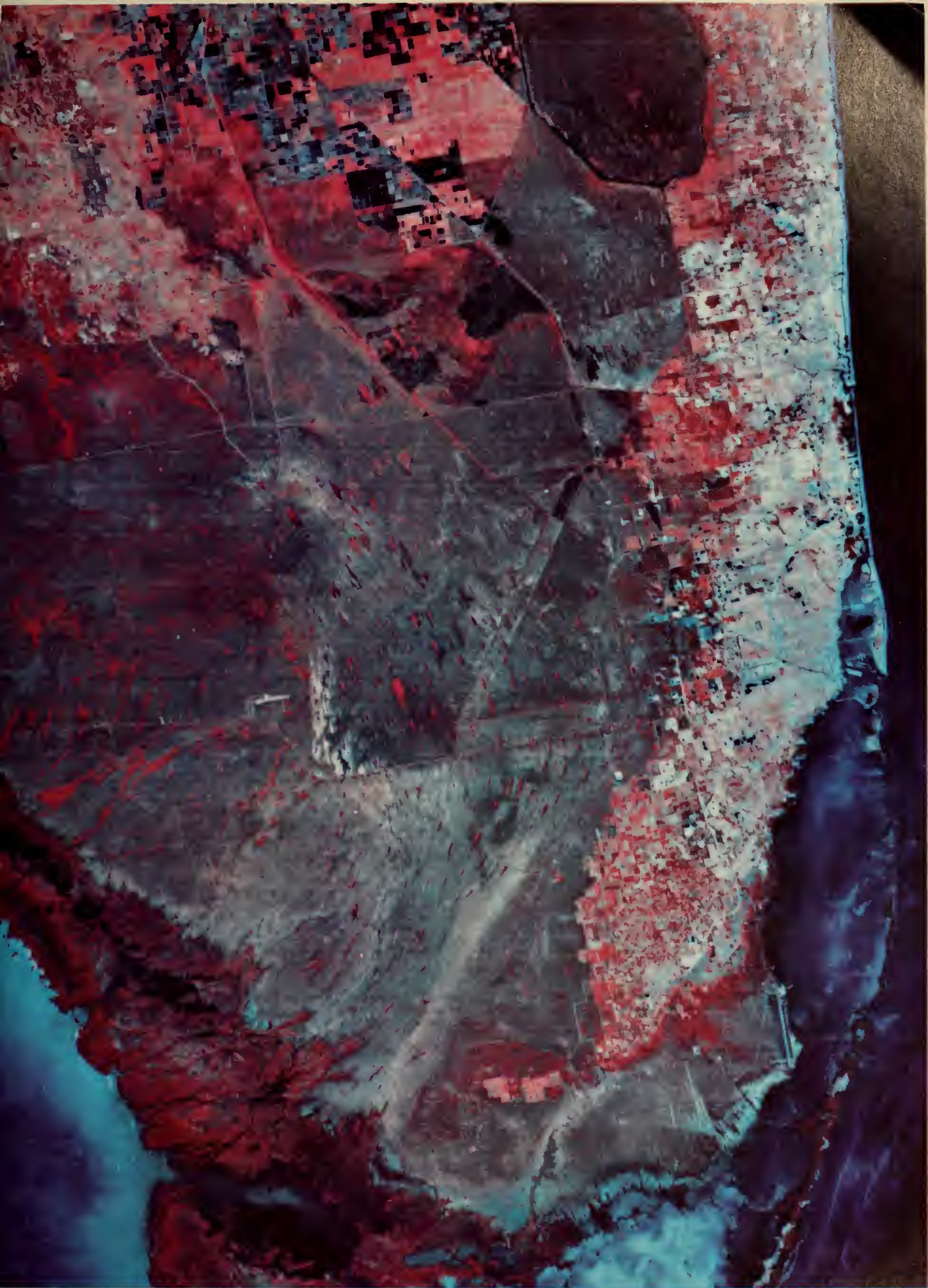
At top side of photo the polygon shaped area is known as Water Conservation Area I. It is one of three water impoundments containing the waters of the Everglades and is laced with several large canals and dikes. The pink tear shaped areas within the Everglades are tree islands. In the overall Everglades region the darker colors represent standing water. For the first time by the use of time varied images from ERTS, hydrologists are now able to determine the distribution patterns of the surface water in the Everglades. This allows them to better calculate the amount of standing water available for water and biological management on a timely basis. Whitish areas are the most densely populated area.

date land-use inventories, and individuals want unique views of their home towns as seen from more than 550 miles above the earth. Inquiries and orders for space images are pouring in from every continent of the world.

Personnel of the Interior/Geological Survey EROS Data Center are working with the most modern equipment in the field to fill the rapidly growing requests for space imagery. But the Center has more than ERTS imagery; it also reproduces and sells photos obtained from aerial photography, and from Apollo and Gemini space flights. By early spring of 1973, just two years after its establishment, the Center had made available more than 2 million frames of imagery; of these, nearly a quarter of a million were ERTS images.

But more than just a Center for selling space photos, the facility at Sioux Falls has become a center of complex technological and educational activity. Assistance in remote sensing interpretation has been provided to users, and formal courses are offered to increase the ability of individuals to interpret and use space imagery. This is all part of the total effort to fulfill the purpose of the Data Center—to provide access to a unique method of studying the earth's resources.





Across Picturesque Lewiston Grade

The Bonneville Power Administration markets electric power over a 12,000-mile transmission grid in Oregon, Washington, Idaho, western Montana and small portions of four neighboring States. This transmission system serves 27 Federal dams, with four more under construction, plus several large hydroelectric and thermal generation plants operated by public and investor-owned utilities.

Like other Interior agencies, BPA is dedicated to the preservation and enhancement of its surroundings—in this case the rugged grandeur of the awesome mountains, fertile valleys and boundless prairies that characterize the great Pacific Northwest. Serving people with power is BPA's prime mission, but it also recognizes the need for doing so with the least adverse impact upon the environment.

This concern was manifested in recent construction of a 12½-mile segment of high-voltage transmission line across the face of picturesque Lewiston Grade in central Idaho. BPA engineers recognized that the high, treeless hillside posed a special challenge in that conventional construction could leave indelible scars upon the landscape. So they turned to a relatively new method of building and stringing massive transmission towers—helicopter erection.

First, material marshalling yards were set up along the Snake River at the foot of Lewiston Grade. Here, the huge tower sections were semi-assembled and fitted with special metal guides for easy, precise erection. Here, too, came truckloads of ready-mixed

concrete from a factory in nearby Lewiston.

Meanwhile, at the site of each tower, preparation of the base or footing was underway. All materials used in this work were transported to the site by horseback and wide-tread, all-terrain vehicles, thus obviating the need for access roads. As the rock excavation and the forms for the concrete footings were completed, shuttling helicopters hauled large vats of concrete to the tower sites. Still airborne, their contents were poured by workmen on the ground.

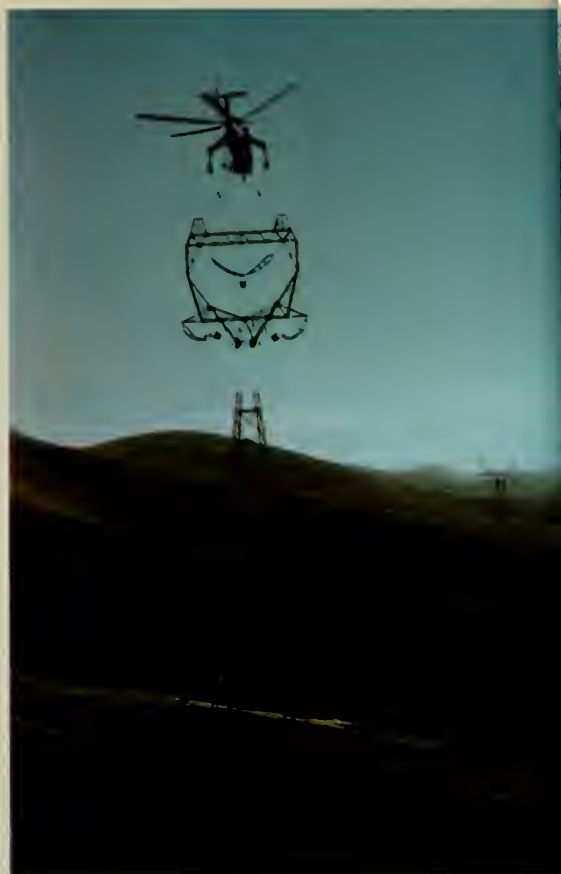
Next, tower sections were flown to the sites and lowered into place. Some of the smaller parts could be transported by Bell 205 helicopters capable of lifts up to 5,000 pounds. Larger sections required a Sikorsky S-64 Sky Crane, which carried loads up to 15,000 pounds.

With the help of the metal guides, workmen bolted the tower components into place. The larger tower bridges or "banjos" were placed in sections. The smaller ones were pre-assembled and flown to their sites with insulators and stringing sheaves already attached.

Completion of the last tower signalled the start of the conductor stringer operation. Again, work was performed by a helicopter, which hovered above each tower, in turn, while workmen threaded the pulling line through the stringing sheaves. The final operation—pulling and tautening the conductors—was done by ground equipment located at four preselected locations along the hillside.

In all, erection of the 41 steel towers along this 12½ mile section of the BPA transmission system required 10 workdays to complete. Once in place, the dun-colored towers blended into the landscape with minimal intrusion upon the natural beauty of Lewiston Grade.

Environmental concern, ingenuity and modern technology made it possible for BPA to carry out its commitment to the people of Idaho and many others who view this panoramic area. But there was a cost involved. In this instance, the "no-access road" construction technology was some \$600,000 more expensive than conventional construction in areas where access roads are permitted. It is one of many trade-offs between economics and preservation of scenic values often faced by this Interior agency as it builds and maintains electric facilities required by the people of the Pacific Northwest.



(Top) Sky Crane positions tower bridge; (Bottom) Lowering a section of transmission tower; (Right) Loading concrete for aerial delivery.





A Better Sort for Trash

Does your neighborhood have a volunteer recycling center? Many communities now have one or more, open usually on weekends. You can take your accumulated bottles, papers, and cans there for return to the industrial supply chain. The idea is to separate these waste products, and deliver them to a central collection point where they can be accumulated for potential users. The separation part is important, because normally people throw out their cans, bottles, and old newspapers all mixed together in the trash. That makes them hard to recover.

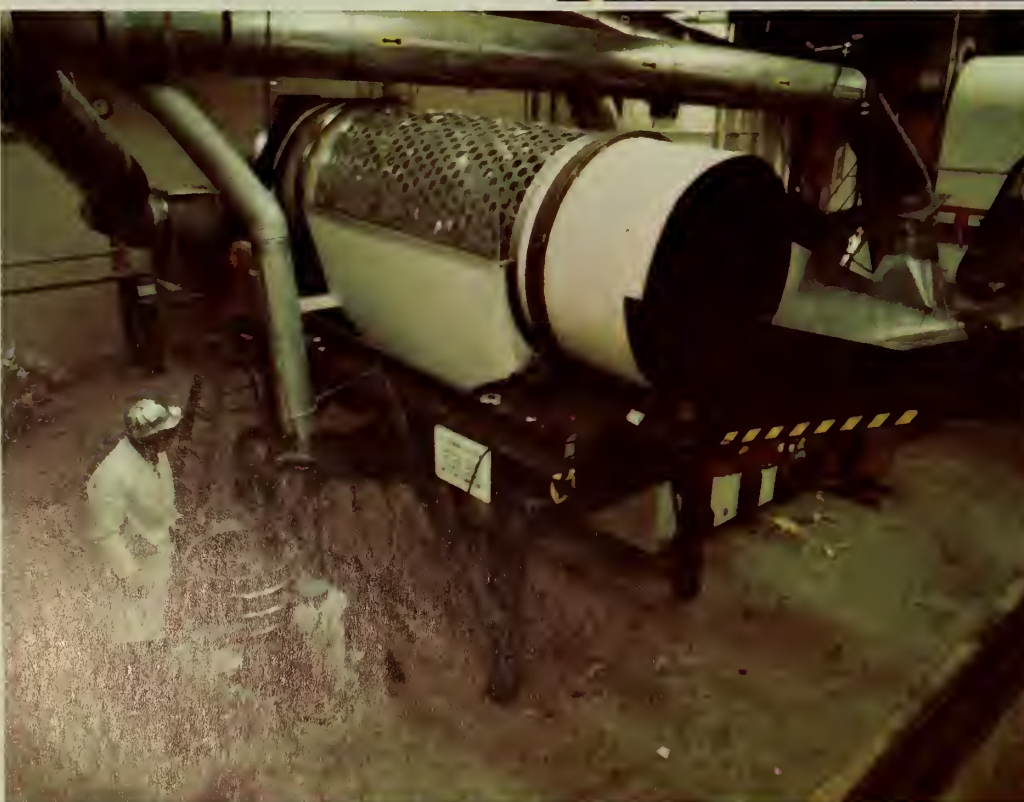
Just one year's accumulation of trash, nationwide, contains 12 million tons of iron and steel, 13 million tons of glass, and over a million tons of aluminum, zinc, lead, tin, and copper. The tonnages of paper, cardboard, and plastic are also staggering. Today most of it goes to waste. And much of it pollutes the environment as ugly litter, or as *unsanitary* "landfill" at poorly controlled dumping sites. All of us suffer from such mismanagement of waste. We suffer through the deterioration of our environment, and we suffer through the loss of valuable resources that inevitably results when waste goes un-recycled.

The immense volume of valuable materials wasted in trash stirred the interest of some waste-conscious metallurgy researchers in the Interior Department's Bureau of Mines. They were motivated not just by the sheer tonnages of metals that go to waste, but by their discovery that the wastes are actually richer in metal content than many ores that are used as commercial sources of metals. The non-metals, and even non-minerals like paper and plastic, interested the metallurgists, too, because of the possibility that such materials could be reclaimed for re-use by separation methods adapted from mineral technology.

Until such ideas are developed into workable technology, however, what recycling there is must be done by hand. At one community volunteer recycling operation, set up on a borrowed corner of a shopping center parking lot, the carloads of bottles and cans are arriving in ever-increasing quantities. "It's been tough



(Top) The experimental Bureau of Mines process for separating useful raw materials from unburned trash and garbage uses "air classification," which works on the ancient winnowing principle. (Middle) A special optical separation technique, used in the Bureau of Mines experimental trash recovery plant, separates crushed glass into clear and colored "fractions." (Bottom) The trommel, a standard item in many ore-processing and coal-sizing operations, is proving useful in trash recycling research. (Right) Relatively clean scrap paper in the bags is one product of the experimental recycling facility for "raw" urban refuse. A large-scale plant operating continuously could produce a steady stream of reclaimed paper in large enough volume for recycling by industry or use as clean fuel.





getting people seriously interested," says the recycling volunteer, a young man in patched army fatigues. "I mean, interested enough to bring in a few carloads of clean items, you know, and then keep on doing it, regularly."

He raises his protective face shield, and wipes his forehead with the back of the heavy glove on one hand. "One sack of aluminum cans, just one or two times—It doesn't help that much. Until a regular *habit* takes over, and people get conscientious about recycling all their household items. . . . Well, I don't see how we can expect to put the waste dumps out of business until that happens, with the system we're using.

"It's a good start, though," he says, repositioning his protective mask and bending again to his work of breaking down a barrel of bottles to fragments of clean glass. "And it's better than nothing, which is all there was, till centers like this one started up."

Something better may be on the horizon. In the technological approach to recycling that the Bureau of Mines is working on, the goal is continuous processing of "raw" trash and garbage by automatic machinery, to produce uniform products of consistent quality and to produce them in quantities that will make them a reliable source of industrial raw materials. The researchers reasoned that a steady, predictable output of recycled materials, at a rate that industrial buyers could count on, would help establish a steady market for reclaimed metals, paper, glass, and plastics. Part of the problem in community recycling efforts is that their output is often irregular.

A basis for believing in the technological approach to recycling household trash was established by the Bureau of Mines just a few years ago. In College Park, Maryland, a suburb of Washington, D.C., the Bureau built a pilot plant that could reclaim all the mineral values—metal and non-metal alike—in the residue from municipal incinerators. Material from the incinerator ashpits contained more glass than anything else—about 50 percent by weight—and its metal content was about 30 percent. By the Bureau-developed process, it was all converted to industrial raw material. Glass fragments were even separated optically according to color.

Operations at the pilot plant were relatively small-scale, yet large enough to show that the process could be scaled up to dimensions capable of

handling the day-in, day-out production of a large city's incinerators. Moreover, study showed the economics to be favorable, so in 1972 an Eastern city started building a full-scale automated recycling operation of its own, incorporating the incinerator residue treatment process developed by the Bureau of Mines. The facility was financed in part by a Federal anti-pollution grant, and is expected to serve as the stimulus for other recycling operations to follow.

The Bureau's success in applying metallurgical technology to incinerated trash lent confidence for the next step—bypassing the incinerator completely by processing raw refuse right off the truck. If it could be done (and signs are that it can), it would offer great promise for bringing the solid waste problem under control—something the community recycling projects, using hand methods, haven't been able to do.

Separating wastes into raw materials, however, is only the first half of recycling. The second is actually using the materials. Here, too, the Bureau brings its expertise to bear through research on new uses for wastes. Some of these wastes now go almost entirely unused, and the community recycling centers cannot accept them.

"I'm sorry," the fatigue-clad recycling worker tells a couple who have just pulled up. "We can't handle plastic containers."

The young man and woman put their cartons of plastic back in their car.

"We wish we could take it, really," the volunteer tells them, as they add some bottles and cans to his collection. "Plastic is biologically indestructible, so we sure hate to see it just tossed out into the environment. But, as far as we know, there's just no way of recycling it. No way."

With its research facilities, however, the Bureau of Mines is looking for ways. For recycling, mixed plastics from the Bureau's experimental plant can be further separated according to their type and composition—polyethylene, polypropylene, nylon, polyvinyl chloride, etc.—by an adaptation of mineral-processing technology called the "float-and-sink" method, which takes advantage of the differences in specific gravity between the different plastic varieties. Research on ways of using these different materials has led to some interesting results. For example, the Bureau showed that polyvinyl chloride scrap is an easy-to-handle source of

hydrochloric acid, much safer to transport and store than the commercial reagent itself. High-density polyethylene scrap, on the other hand, can be injection-molded into new plastic products.


This kind of work takes time, of course. Community recycling centers will not be replaced tomorrow by trash-sorting plants that ship their products directly to eager industrial consumers. The technology and economics of the process must be further proved, and in many cases new markets will have to evolve for some now-disregarded wastes. But at least the effort is under way. In the meantime, thousands of ecology-conscious people—including some of the Bureau's own recycling researchers—will keep making their weekly deliveries of cans, bottles, and papers to the volunteer centers.

III LAND AND WATER FOR ALL



Unceasing panoramic vistas dot Jewels in the Crown lands. (Right-Page 63) Looking below dedication site of 30-mile Birds of Prey Natural Area near Boise, Idaho; (Left-Top) a frequent Birds of Prey resident; (Middle) Humbug Spires Primitive Area near Butte, Montana; (Bottom) Bear Trap Canyon through which Madison River flows near Ennis, Montana.





Jewels in the Crown

It was probably a prospector in the early 1860's who named them. Wandering through these up-ended granite shafts, some towering hundreds of feet into the clear Montana air, he finally sputtered in disbelief, "Bah! Humbug!" However they may have come to be named, the Humbug Spires in southwestern Montana still strain the credulity of people who walk among them.

The Humbug Spires have now been set aside and dedicated as a primitive area, to be managed by Interior's Bureau of Land Management.

It may have been a miner's wife who named the Calico Hills in Southern California, after comparing her flour-sack dress with the many hues and tones displayed in rocky cliffs and canyons.

The Calico Hills have also been set aside as a special area and dedicated as part of the recreation assets of the California Desert, along with other such colorfully named areas as Old Woman, Chuckwalla, and the Trona Pinnacles.

The names go on: Powderhorn Primitive Area, in the Colorado high country . . . Grand Gulch, in Utah's canyonlands country . . . South Pass, historic route of thousands of pioneers.

The areas are fully as colorful as their names. Gunnison Gorge, a half-mile-deep slash across Colorado's west-slope plateau; the Eastern Mojave Recreation Lands, three-quarters of a million acres of parched California desert; Bear Trap Canyon, with 13 tumbling miles of the Madison River in Montana; and the Birds of Prey Natural Area, dedicated along the Snake River in Idaho to preserve a vanishing habitat for soaring hawks and eagles.

These are the Bureau of Land Management's "Jewels in the Crown," a blue-ribbon list of the spectacular, the unique, the vast, the priceless bits and pieces of both man's and nature's history on this continent.

A Love Affair with the Land

That there's anything left to call Jewels in the Crown is a wonder in itself. These are the left-overs of the original public domain, that one-fifth of America's land area which has already yielded most of the National Parks,

Forests, and Wildlife Refuges in America.

The Jewels in the Crown are being identified and named because of people's growing love affair with the land. The land has been there, and people have been using it for a long time. But now, instead of a few neighbors who've known the land intimately, the visitors to the National Resource Lands include thousands of transcontinental travelers. In their minds, these tracts must have names and boundaries and signs to have significance.

In designating and naming the Jewels in the Crown, the Interior Department is *not* inviting hordes of visitors who may expect comfortable roads, fully equipped campsites, and uniformed attendants. To even find the Jewels in the Crown may be a challenge. Many are poorly mapped, few have any visitor facilities. You may get lost, or stranded, and have to hike out. But for some, that's another part of the challenge.

Improved access roads, maps and brochures, visitor centers and camping facilities will come in time for many of these areas. But meanwhile, and often long in advance of heavy visitor use, these outstanding areas are being named and dedicated in public ceremonies.

The Land Nobody Wanted

The National Resource Lands are the remainder of the original public domain—an expanse that once stretched from the Ohio River north and west all the way to the Pacific and across most of Alaska.

The public domain has provided land for State school systems, a land grant college system, transcontinental railroads, National Forests, National Parks, National Wildlife Refuges, and Indian and military reservations. It provided homesteads for more than a million settlers, for thousands of others who earned land for military service, and for miners who found and developed mineral resources.

From original public domain holdings of 1.8 *billion* acres, Uncle Sam has disposed of 1.1 *billion* acres, leaving 705 million acres of public domain still in Federal ownership.

Later added to the public domain are 55 million acres of Federal lands acquired for specific purposes, mostly in the East where there was never any public domain.

Combined, the public domain and acquired lands now total 760 million acres, of which 310 million acres are designated for Federal purposes. The largest category of such designated lands is the National Forest System, with 186 million acres.

The remaining 450 million acres are the National Resource Lands—which until recently had no designated purposes. They were not held in Federal ownership for some special need, or because of any conscious decision, but because none of the now obsolete disposal laws fit them.

These were lands that couldn't be farmed for lack of water, lands unprofitable for a private owner because of low unit productivity and taxes, lands too remote from roads and towns and utilities to be attractive as homesites or business sites. Their official title was "the vacant, unappropriated and unreserved public domain." When the Federal Government cut that title to "public lands," it created confusion because there are many other types of publicly-owned lands.

The name "National Resource Lands" was adopted in February 1972. The same name is carried on bipartisan legislation in both Houses of Congress to identify and distinguish these lands from other categories of publicly-owned tracts.

For thirty years, from 1934 to 1964, the Interior Department—first through the Grazing Service and then through the Bureau of Land Management—administered these lands "pending their ultimate disposal." Some acres were sold and some were used to satisfy outstanding obligations to the States, but the era of homesteading had ended.

The Classification and Multiple Use Act of 1964 gave the Secretary of the Interior authority to classify public domain lands for a variety of public purposes, or to sell those lands better suited for private ownership. Though this was only interim authority which has now expired, the Secretary may continue to make special designations for lands classified under that Act.

Thus the lands that nobody wanted during the long era of free-and-easy disposal of the public domain now have a status of their own, and finally a name of their own—the National Resource Lands.

Snow for America's Switzerland

On the narrow highway, wending a serpentine path that offers spine-tingling views, cars bearing out-of-state licenses form an almost constant caravan during the summer under the face of southwest Colorado's spectacular San Juan Mountain range.

Even when the calendar proclaims summer, there is a chill to the winds that play about the 14,000-foot peaks in what is known as the "Switzerland of America."

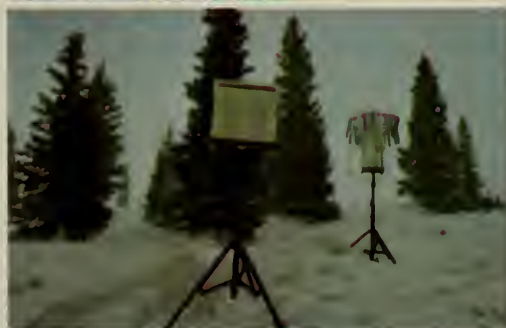
Of the thousands of tourists who visit this alpine wonderland, it is likely that few of them are aware that nearby is the site of a scientific research project that has captured international attention and that holds immense promise for water-short areas of the western United States.

Colorado River Basin Project

It is the Bureau of Reclamation's Colorado River Basin Pilot Project, designed to determine how cloud seeding can most effectively be applied on a large-scale basis to augment runoff of the Colorado River, the lifeline of the seven states which it touches or to which it contributes its runoff.

As summer of 1973 waned, teams of meteorologists and other scientists, technicians, and student research assistants prepared for the fourth consecutive winter season of cloud-seeding operations in the project area that lies along the windward side of the Continental Divide, rooftop of the Nation. The work is not confined to men of science. Housewives, ranchers, and a sprinkling of high school students are among those employed in the pilot project.

The project area (1,600 square miles) is larger than the entire State of Rhode Island. The project commands the services of some 150 full- and part-time employees. More than 200 instruments and gauges are installed and used in and around the target area. They record great masses of data on wind and temperature, pressure and precipitation, on a day-to-day, hour-by-hour basis.



(Left Top) Looking south in the Animas River Canyon; (Right Top) checking effects of a burning silver iodide generator; (Right Bottom) changing chart on a wind gauge; (Center) 1—observing a boreal toad, a creature highly sensitive to area's ecology; 2—controlling silver iodide by aircraft crew to encourage freezing of water droplets in a cloud; 3—experiencing a storm at weather station.

From these data, Bureau of Reclamation scientists expect to provide definitive answers to the questions: What additional precipitation does cloud seeding provide? At what cost? With what reliability? Under what conditions? And what are the physical, social and environmental considerations?

Project Skywater

To explore these and other issues, the Bureau of Reclamation conducts an extensive research program dubbed, "Project Skywater." It involves special studies and activities by several contractors in many states. The Colorado River Basin Pilot Project is one of three field programs (others are in North Dakota and Nevada) that represent a critical link in the scientific transition from basic research to operational adaptation.

Project Skywater is directed by the Division of Atmospheric Water Resources Management at the Bureau's Engineering and Research Center in Denver. The project began in 1961, when Congress appropriated \$100,000 for Reclamation to explore cloud seeding as a possible water resources tool.

The Colorado River Basin Pilot Project was conceived in 1968, but because of extensive planning requirements, seeding was not begun until the winter of 1970-71.

The operation involves careful analysis of winter storms as they approach the mountainous target area. As warm moist air is forced up and over the Continental Divide, clouds are formed which deposit much of their burden of snow on the southwest-facing slopes of the massive San Juan Mountains.

Seedable Storms

Based on criteria related to temperature, humidity, and other factors, about half the storms are considered "seedable." When a "seedable" storm comes along, a random decision is made whether or not to treat it— that is, to seed it with silver iodide crystals produced by a network of 33 ground generators located upwind of the target area. Only about half of the "seedable" storms are seeded.

Extensive data are collected on each storm by a host of airborne and ground instruments to be analyzed on the basis of seeded versus unseeded cases. After three winter seasons of operations, Project Skywater officials say a preliminary comparison shows a

significant increase in precipitation from seeded storms. But a more comprehensive assessment must wait the full term of the pilot project—that is, four, possibly five winter seasons of randomly seeded storms that meet criteria, followed by a scientific examination of the results.

"We are searching," says Dr. Archie M. Kahan, Chief of the Bureau of Reclamation's Division of Atmospheric Water Resources Management, "for a faint signal against a very noisy background, unfailing scientific evidence that man can impose a positive effect on a natural phenomenon that varies widely and frequently."

Dr. Kahan joined the Bureau in 1965 after a distinguished career in which he engaged in research and administration at Texas A&M University and later at the University of Oklahoma. Notwithstanding his scientific restraint, Dr. Kahan occasionally exhibits a romanticist's appreciation for such sights as a flotilla of fleecy clouds parading across a blue summer sky.

Lifeblood of Rivers

Indeed, summer clouds and their stimulation for added rainfall are an important part of Project Skywater research. But in directing the Colorado River Basin Pilot Project, Dr. Kahan and his staff are most concerned with winter storms that provide the lifeblood of all western streams and rivers.

Snow deposited in the high mountains feed them all. The river's flow is governed by the amount and character of the mountain's snowpack. The snowpack is, in turn, a product of the uncertain and infrequent storms that travel the winter skies over the Rockies.

"Mankind has yet no way of influencing the frequency of such storms," explains Dr. Kahan, "Nor can we influence precipitation from all kinds of atmospheric circumstances. But we are learning the means by which we can improve the precipitation production of certain kinds of clouds."

An important stepping stone toward this knowledge was provided by Lewis Grant, professor at Colorado State University and more recently a consultant to Project Skywater. During the late 1950's and early 1960's, Professor Grant and his staff conducted seeding experiments on winter-time clouds in the Colorado Rockies for both the National Science Foundation and for the State of Colorado.

Silver Iodide is Released

After hundreds of seedings, they found that precipitation increased when silver iodide crystals were released into clouds whose uppermost temperatures ranged between minus 5° and minus 23° Centigrade. It is in this temperature range that silver iodide functions best, and that naturally occurring materials are least effective in furnishing the nuclei needed to produce precipitation.

The critical role of these temperature values in seeding winter clouds is well established, but the pilot project now seeks additional data.

"Simply stated," says Dr. Kahan, "our objective is to be able to report that, by cloud seeding, we can produce x acre-feet of additional water at a cost of y dollars and with a statistical reliability of z. We hope to accomplish this in a socially acceptable and environmentally sound fashion. We in the Bureau of Reclamation have the responsibility of assigning hard values to the unknowns—x, y, and z."

When the pilot project was conceived in 1968, the Bureau of Reclamation called on Professor Grant and Colorado State University to prepare the design. It proposed the random seeding of storms meeting specific criteria for a period of at least four winter seasons, to provide a number of cases of seeded and unseeded storms sufficient to yield statistically significant results.

San Juan Region Chosen

Selection of the operations area was of major importance. The San Juan region was chosen for its contribution to the Colorado River runoff through a number of tributaries; for the presence of an existing network of precipitation gauges and other instruments; and because virtually the entire region is publicly owned.

Individual contractors were selected to conduct seeding and field activities, to install the instruments and to collect data for the full period of the project. EG&G, Inc. through its Environmental Services Operation at Albuquerque, N. Mex., is the seeding contractor and Western Scientific Services, Inc. of Fort Collins, Colo., is responsible for the instrumentation and data acquisition. Both have established offices at Durango, Colo., headquarters for the project.

Communities Question Project

Residents of mountain communities near the project area were less than enthusiastic when the project was first announced. They voiced fears of record amounts of snow, of spring

floods and winter hazards, of an abbreviated summer tourist season, of ground water conditions that would imperil mines that contribute heavily to the area's economy.

These and other concerns were answered (and a spirit of mutual trust was born) in a series of public meetings in several communities: Silverton, Telluride, Ouray, Lake City, and Pagosa Springs.

Three times hearings were conducted in those communities where interest ran high. To keep residents and local and State officials fully advised of developments, a Project Skywater newsletter was developed by the Division of Atmospheric Water Resources Management and is mailed at frequent intervals to a list that has grown to nearly 250 persons.

At public meetings, in correspondence, and in frequent and casual conversations between Project Skywater officials and local residents, the exchanges were sometimes brisk and always honest. They demonstrated that the project was flexible, and that residents had the opportunity to shape it in significant ways.

Avalanche-Prone Area

"We live in the most avalanche-prone area of the Nation," local citizens said. "What do you propose doing about this threat?"

There are, in fact, 49 specific avalanche runs that intersect the "Million Dollar Highway" (U.S. Highway 550) that links Silverton and Ouray. These steep courses pose a very real hazard to motorists in the winter. But, it is not known whether or not additional snow would increase this hazard. What, indeed, might be done?

Even though the highway and the communities are outside the seeding target area, the Bureau turned to the University of Colorado's Institute of Arctic and Alpine Research (INSTAAR) for an intensive study of avalanches to determine what causes them to occur at particular moments, and how they may be forecast, diverted, or controlled.

Howitzers Used to Shoot Avalanches

Highway crews and ski operators have used recoilless rifles or howitzers to shoot avalanches, the most common control technique. Not always, of course, have they beaten nature to the punch. The Colorado Division of Highways uses three 75 mm. howitzers, on loan from the National Guard, in its avalanche-control program. During the 1960's the Division built a massive concrete

snowshed at the site of one of the worst avalanche runs atop Wolf Creek Pass, which lies nearly at the geographic midsection of the Colorado River Basin Pilot Program.

Despite these controls, however, little effort has been directed in this country to accurate understanding of the avalanche phenomenon or to innovative steps to control the devastating slides.

Two winters ago in performance of the Reclamation contract, a five-member INSTAAR team took up residence in Silverton and established a mountain-top observation post where, during snowstorms, they made exhaustive studies of snow density and accumulation in known avalanche areas. They also measured and evaluated scores of slides during the winter in an effort to build an avalanche "profile" from which new ways could be found to anticipate and control nature's "white terrors."

Environmental Effects

What are the environmental effects of cloud seeding? Environmental considerations previously viewed academically attracted new recognition with the pilot project. Already in progress was a special study by a University of Michigan research team into the ecologic effects of weather modification. Completed in 1969, the study suggested any changes produced by cloud seeding probably would be gradual and subtle, some for better, some possibly for worse. But, research was needed!

To explore the study's theoretical findings, an intensive ecologic investigation was ordered as part of the Colorado River Basin Pilot Project. It is being conducted by Colorado State University, the University of Colorado, and Fort Lewis College of Durango, Colo.

The ecologic studies continue year-round, and emphasize items most sensitive to ecologic change—that is, living things that provide the earliest and most reliable barometers of possible change. Among them, curiously, are boreal toads—amphibians that are the most fragile inhabitants of the alpine eco-system.

These and other occupants of the project area—squirrels and shrew, elk and rabbits, flowers and native grasses—are counted and catalogued so that their numbers and growth may be monitored in selected test plots throughout and beyond the period of the pilot project.

Another part of the ecologic study

involves the reconstruction of the area's climatic history. No formal records now exist, so tree-ring dating is in progress to enable scientists to build a weather history and to determine what trends may already be in progress as a natural step in the area's evolution.

Natural Change in Climate

"It is eminently reasonable to postulate that the San Juan Mountains may be experiencing a (natural) shift in temperature and precipitation," say the ecologic investigators. "If this is true, then it follows that the ecological conditions of the target area are already shifting in response to this natural change in climate."

Thus what began 5 years ago as a research program to evaluate cloud seeding as a tool to augment water for the Upper Colorado River Basin has taken on a much deeper character, with far greater dimensions than originally envisioned.

"We have not lost sight of our goal," said Dr. Kahan. "Our mission remains one of determining the worth of cloud seeding as an economic, efficient, socially acceptable and environmentally sound water augmentation tool. The complexities of that challenge are nothing short of staggering, but they are enormously exciting. We have made enormous progress. We shall achieve our goal."

"Particularly gratifying is the awareness that scientific investigation spawns new ideas, new objectives and new benefits to mankind. We have rediscovered these truths with the pilot project."

Night view of silver iodide generator.



Dripping Pipes Save Water

A dripping faucet is wasteful of water and will run up a bill, but a drip in the irrigation pipe may save water, manpower, and cash. That is the contradiction—and also the promise—of drip irrigation.

It was Dr. Symcha Blass of Israel in the early 1930's who observed a water drip from a leaking pipe and the effect it had on the health and production of an orchard tree. When he tried to devise a method of drip irrigation on a commercial scale, however, he ran into real problems.

Dr. Blass' early scheme didn't work out well, for his available pipes tended to corrode and the pin holes stopped up with solids. In addition, the system was too erratic, with some "leaks" dripping so much that the soil became water logged while other emitters stopped prematurely and growth of plants was stunted.

With the availability of plastic pipes in the late 1950's, experiments of Dr. Blass in drip irrigation began to work. Rather quickly thereafter, thousands of acres of agricultural land in Israel were put under drip irrigation. The same applies to Australia, South Africa and Mexico. Farmers in these countries welcomed a way to make use of scarce water and double agricultural production.

To American farmers, drip irrigation was a novelty. There seemed to be ample irrigation water available at

Drip system on young almond orchard. Water is delivered by buried plastic line.



reasonable cost for conventional surface flooding or sprinkling. The initial higher costs of drip installation seemed to outweigh the advantages of saving water. Suddenly, however, the economics of drip irrigation changed.

Farmers now know that demand from municipal and industrial users means that they will have to stretch their available irrigation supplies. Underground water supplies are being reduced from excessive pumping and little new water will be available to most farmers from surface collection and distribution projects. Rising labor and other costs seem to limit major switch-overs into more profitable agricultural production such as orchards and vegetables, especially with no assurance as to available water supplies.

Drip irrigation offers the promise of making better and more economical use of scarce water.

Preliminary and limited observation by Bureau of Reclamation specialist Joseph B. Marcotte, Jr., indicates that new drip irrigation techniques may greatly increase production, with savings of 10 to 50 percent in such important areas as water, labor, fertilizers, and harvesting.

This means, for example, that a farmer wanting to switch over from low-paying crops or those in surplus may be able to afford the capital costs of drip irrigation and development of crops such as avocados, grapes, olives, nuts, and vegetables.

Many problems have yet to be resolved for successful drip irrigation in the American context. In some areas, water is so full of salts that special equipment and new horticultural techniques are called for. Not all soils or terrain are suitable for drip techniques of watering, tilling and harvesting. Farmers, suppliers, and bankers who make loans, all must be "sold" on the soundness of the idea, and county agents and engineers have to be trained to give advice and assistance.

However, a lemon orchard near Yuma, Arizona, under drip irrigation was reported by observers to have used 1/9th the water, 1/16th the labor cost, with only 2/5th the normal cultivation and 1/5 the fertilizer, and the yield of lemons doubled.

Such success may result from a rare combination of interest, skills, climate, soils, crops, market, and timing, as well as other factors, but the promise seems to be there. Many farmers are sitting up to take notice.

"Bogus is out of Control!"

Lightning slashed into the bone-dry, runty sagebrush in the high desert country of eastern Oregon. Even as the thunder still rolled there was a thin, twisting curl of smoke and a crackling flame. The Bogus Creek fire had started.

Larry Parry saw the bolt strike halfway up the hill from where he was working. He was more than 75 miles from the District Office, he was alone, and he had a wildfire to fight.

In the District Office at Vale, Oregon, Fire Control Officer W.G. Sanderson was signing a requisition. In Boise, Idaho, Ron Kalcso was unwrapping his lunch at the Boise Interagency Fire Center. Joe Kastelic in Anchorage, Alaska, was finishing a mid-morning cup of coffee, and farther north in Fairbanks Roy Percival was inspecting warehoused firefighting supplies.

During the next three days, wildfires on western rangelands and the Alaskan tundra would command the full attention of these men.

12:13 P.M., MONDAY—Using the radio in his pickup truck, Larry Parry reported the Bogus Creek fire to the District Office. Then for the next 15 minutes he shoveled dirt along the fireline, trying to halt the fire. When this failed, he radioed for help.

"Send me an operator for the 'cat!'" he ordered. The "cat," an earthmoving vehicle left over the weekend on the construction site, might be able to construct a firebreak fast enough to contain the fire, he thought.

The District Office radio dispatcher responded with practiced ease. In 2 minutes the heavy equipment operator was enroute by helicopter to the spreading fire 75 air miles away. Also aboard the helicopter was additional help—a 5-man "helitack" crew that had been trained and equipped to be the first headquarters supplement to be sent to attack a new fire.

For the next 10 hours Larry headed a firefighting effort that ultimately would require several hundred trained firefighters from several states and much more equipment and supplies. Before it would be controlled two and a half days later, the wildfire would burn 21,150 acres of rangeland.



(Left Top) Forest fire in young growth. (Right Top) Three BLM smokejumpers drift toward spruce forest fire that has head start on them. (Right Middle) Plane sprays chemical retardants to erect barrier in path of blaze. (Left Bottom) Strategy session maps action to tackle fire from ground. (Right Bottom) Fire fighter starting backfire to control blaze.





Young Larry Parry, short and powerfully built, is the number one Fire Boss in the Bureau of Land Management's Vale District in eastern Oregon. But when the lightning struck on Monday, July 24, 1972, he was working at his regular job as a Range Technician. He was in the Bogus Creek drainage, working alone on the construction of a stockwater pipeline to bring water from a spring high in the hills down to a pasture at 3,500 feet elevation.

Sanderson left the requisition half-signed and ran for his truck. He spun it rapidly in a half circle backward, then sped through the fireyard gate and south down the highway toward the Bogus Creek fire. Sandy knew by long experience what could happen at the fire scene and how much help could be needed.

In Vale, Sandy has 75 fire crew members. These are the District Office Staff people who are trained and experienced. Sandy also has seasonal employees trained in firefighting, and a fireyard with appropriate equipment. In addition, he contracts for specialized equipment like helicopters on a standby basis, immediately available when needed in the fire season.

Now, in late July, the 1972 fire season was well advanced. In the two

(Top) Workers load borate into mixer. When mixed with water, borate becomes a slurry which literally can be rained on a fire. (Middle and Bottom) Firefighters moving to fire location.

previous days Sandy had sent ten, 19-man firefighting crews to five fires in Oregon and Nevada. The same day the Bogus Creek fire started, Sandy also dispatched six crews to other wildfires in Oregon and Colorado. These crews, composed of migrant agricultural workers with special firefighting training and experience, were drawn from a manpower pool of firefighters numbering 500 in the Vale District.

As Sandy raced his radio-equipped, 4-wheel-drive truck towards Larry's tiny firefighting team, he thought through the present deployment of men and equipment. He calculated what forces he should keep in reserve, what he would have to order out to battle the rapidly spreading Bogus Creek fire.

1 P.M., MONDAY—Despite the supplement of the 5-man helitack crew, Larry needed more help—much more. Modern firefighting is an adroit blend of manpower buttressed with technology, and Larry as Fire Boss already was reaching out for technological assistance. Forty-seven minutes after he first reported the fire, he radioed for a retardant airplane. These aircraft carry a thick mixture of fire retardant chemicals and water which is dropped along the fireline.

1:24 P.M., MONDAY—Twenty-four minutes after Larry radioed for a retardant drop, a big, 2-engine C-119 cargo plane cleared the airstrip at Boise, Idaho, and began winging its way some 75 miles southwest to the Bogus Creek fire.

1:55 P.M., MONDAY—Thirty-one minutes later, with three retardant planes in the air, Larry asked that all three go on constant turn-around service until further notice.

3:22 P.M., MONDAY—Larry radioed the District. *"Bogus is out of control and I'm going to need a lot of help."* He asked for three more slip-on units—water tanks that fit on the rear of one-ton trucks—and two more helicopter 5-man crews. Then he called for backfire torches to use a mile ahead of the front. The fire was running faster now than the capacity of men and technological assistance to encircle it.

4:47 P.M., MONDAY—Sandy ordered out six more organized crews and requested that 27 men be sent from the BLM Burns District immediately west of Vale. They would work as pumper truck backup men. Then he advised the BLM State Office at Portland that the Bogus Creek fire

had spread over 3,000 acres. The next thing that Sandy would need would be food for the men on the Bogus Creek fire. This would come from BIFC—the Boise Interagency Fire Center.

5 P.M., MONDAY—The atmosphere at BIFC was one of quiet, controlled efficiency despite the complex logistics which are involved in a Federal firefighting system that spreads over more than half a continent. BIFC is a Federal firefighting service facility administered by BLM in cooperation with the U.S. Department of Agriculture's Forest Service and the U.S. Weather Service in the Department of Commerce.

BIFC's nerve center is a cool and quiet room on the second floor of a building constructed specifically to house the interagency organization which was created to unify Federal fire suppression efforts.

The room is never empty, and its 22 telephone lines are seldom all silent at the same time. They are answered by three Fire Communicators who take orders for such fire support items as personnel, supplies and equipment, special tools, firefighting clothing and headgear, food, and transportation including aircraft.

On this day, the pace has been building inexorably. In addition to the Bogus Creek fire, BLM's Miles City, Montana, District has a fire. When District forces saw the fire's progress outstripping their capacity, they telephoned the Montana State Office to start marshalling additional assistance.

BIFC ultimately answered a request for "overhead" assistance (men, supplies, equipment), and the Miles City team by now sees containment (encirclement of the burning area) just ahead.

5:30 P.M., MONDAY—Throughout the City of Boise, offices have closed, stores are empty of customers, people are heading homeward, traffic is building up, and for most people the workday is over. But at BIFC, a long, tense night is just beginning.

"Nothing more requested from Miles City for the last several hours. They probably have all the help now that they need to handle that one." So run the thoughts of Ron Kalsco at BIFC.

Ron is BIFC's Chief Dispatcher, and he is the Duty Dispatcher for this shift which will go until 10 p.m. Stocky Ron, who is noted for his colorful Western-style shirts, is a highly respected decision-maker.

He has completed more than 250 hours in the various schools of fire

suppression which the Bureau operates periodically. His courses include Fire Zone Planning, Fire Generalship, and Air Attack Boss. He has been a District Fire Control Officer.

Across the desk from Ron sits a man equally skilled in fighting wildfires, Ed Heikkenen, the Forest Service Coordinator, who is doing the same job for fire suppression efforts on National Forest lands.

Ron and Heikkenen have been at work since 2 p.m., 3 hours ago. Their first task was to get briefed by the men they relieved: weather, fires being serviced, crews assigned, and—very important for the fires which BIFC must service—what specially rated and experienced men are available for the staff and supervisory positions that must be filled on the actual fireline.

For the next several hours, they must watch closed circuit television aids, check the pigeon hole compartments of active fire orders being filled, and read the logs of the various fires which have sought BIFC assistance.

They must keep the weather briefing data in mind, watch the solitaire-like table top display of cards which lists the trained fire experts and crews that are still available if needed for dispatch to further emergencies.

Their most important responsibility is to keep a constant mental inventory of the changing Federal firefighting situation. As a result, much of the time they listen to just the BIFC side of conversations as their three Communicators talk to fire commanders and fire liaison men throughout the West and Alaska—and they stand ready to move in on any fire emergency that requires their overall perspective.

As Ron monitors a fire in Alaska which requires BIFC assistance, he pictures the problems and the men handling them, Joe Kastelic and Roy Percival.

Joe Kastelic is Chief, Division of Fire Control for the Bureau in the State of Alaska.

Joe's fire education record is similar to Ron's, and includes studies in fire weather forecasting, fire retardants, and a Fire Staff and Command Seminar.

Another of Ron's longtime acquaintances in fire suppression is Roy Percival, who is Chief, Division of Fire Control for the Fairbanks, Alaska, Fire Control Station.

Roy has been a Supervisory Smoke-jumper, has studied at the Fire Service Chief's school, and has been schooled

in Aircraft Management for Fire Suppression.

These men typify the elite professional in Federal fire suppression: schooled and long-experienced.

Roy Percival's job in fighting wildfire in Alaska is about as different from Sandy's job in Vale, Oregon, as a candy bar is from a bowl of soup.

The Vale District covers 4½ million acres of BLM administered National Resource lands. BLM also has contracts to protect both private and State lands in the area, and thus extends Sandy's total responsibility for firefighting to more than 6 million acres.

Roy heads a firefighting complex out of Fairbanks in interior Alaska. The Bureau, as the principal fire suppression agency in the State of Alaska, protects 220 million acres of State lands, Indian lands, and other Federal lands through cooperative agreements.

Sandy can take a 4-wheel-drive vehicle either on roads or cross-country throughout most of his area. But in Alaska, Roy has few roads, and environmental conditions are such that wheeled vehicles cannot operate well, if at all, in the spring and summer fire season.

7:29 P.M., Monday—Larry Parry and Sandy were hunkered down over a map which Larry had prepared. They were checking the present deployment of men and determining where additional forces would be needed tomorrow.

The Miles City District Fire Control Officer jotted a note in his fire log and turned back to answer his telephone again.

In Alaska, both Roy Percival and Joe Kastelic were talking on the telephone, too: Roy to one of his primary fire operations area offices and Joe to BIFC.

One of BIFC's Fire Communicators, Roland Parkhurst, finished a phone call and punched the button on another incoming line. "They want overhead personnel at Bogus Creek tomorrow," he told Ron. Ron decided on the best and nearest qualified men for the command posts, and handed over the cards which listed them.

Fighting fire is more than just putting men on a fireline. Men need equipment—and lots of it. They need shovels and other hand tools, chain saws, back-pumps, and flashlights. They need fire shirts and hardhats, first aid kits and canteens. They need coffee and food, and if they're going to be on the fire-

line long, they will need sleeping bags and even portable showers and disposable toilets.

Put a lot of men on a fire, and you must have a line organization. A Fire Boss needs Crew Bosses to direct the men on the fireline. If his fire grows, the Fire Boss needs Sector Bosses to supervise the Crew Bosses. The larger his fire grows, the more trained supervisors he needs. Above the Sector Boss level, he may ultimately need a Line Boss, a Service Chief to handle incoming supplies and equipment, a Plans Chief to map the fire's progress and probable direction, and a Finance Chief to handle aircraft and equipment rental plus details of hiring and paying people.

8:15 P.M., MONDAY—As Ron listened, read logs, and kept revising his mental inventory, he noted a changing pattern in the requests for assistance that were coming into BIFC. Now the calls were for more service kits for supervisory personnel.

Service Chief, Plans Chief, Finance Chief—these men must set up an office in the field right where the fire is. BIFC stocks for instant shipment the necessary kits for each of these jobs, plus 38 other specialized kits.

A backup Chief's kit contains everything he needs to function, including the box which the kit comes in and which converts to a field desk.

Each kit has been planned to the last detail. For example, a Plans Chief must plot a fire's probable direction and make a map right on the spot for his Fire Boss. There's no going back to the office for drafting tools like a triangle or a protractor.

10 P.M., MONDAY—Ron worried one of his perennial toothpicks for a moment and drained the last of the coffee from his paper cup. He had briefed his relief Dispatcher and was ready to go home. He glanced at the diminishing stack of cards listing the available rated fire personnel. Ron had an inner hunch that the night might get busy pretty soon.

On the Bogus Creek fire, Larry Parry bedded down for the night, exhausted after struggling to get a fire contained that was less than 100 feet square when he first started shovelling dirt 10 hours ago. His relief already was handling the details of being Fire Boss. Larry dropped off to sleep almost instantly.

Sandy made a mental note that the crews over in the Burns District would be available after a night's sleep.

On the Miles City District, they were

mopping up the remains of the fire, pulling men out, loading up equipment, straightening out records.

Somebody handed Roy Percival a paper cup full of steaming coffee. He sipped at it while he checked out details of two lightning-caused fires in interior Alaska and mentally sized up his available resources. He decided that he had better put more men on the bigger fire.

Joe Kastelic, knowing that Roy was on top of his problems, headed home for dinner. He left word for his staff to call him if the situation worsened.

Back at Boise, the BIFC retardant planes had been on a constant turn-around schedule for almost 10 hours. Communicator Roland Parkhurst took a phone call.

"Bogus Creek is ordering the retardant planes stopped for the night," he reported. "Sandy says that the fire is so large and so fast they're not buying a thing with it. They'll have more men in the morning."

Roland logged the message and wrote the Stop Order, cancelled the retardant planes, and drew coffee from the 40-cup urn that supplied each shift with a constant supply.

11 P.M. MONDAY—At Bogus Creek, the wind had died down, the rapid advance of the fire had slowed, and the firefighters were trying hard to build a firebreak in front of the fire. If they succeeded, they would start a backfire which in the absence of brisk winds would burn back toward the fire and stop its forward advance.

Encirclement attempts were also going on and succeeding in Alaska on one fire, but were doubtful of success on another and on two new ones. The lightning forecast had been accurate, and Roy Percival and Joe Kastelic were facing new developments.

At Miles City, no new fires had started, and the prevailing winds were mild enough over Oregon and Idaho to keep thunderheads and their dangerous lightning potential from moving over Montana until sunrise or mid-morning.

Although there was plenty of activity on the firelines, things were relatively quiet at BIFC for the next three hours.

1 A.M., TUESDAY—At Bogus Creek the weary crews were still trying to encircle the fire. Sandy had ordered in the crews from the Burns District, and they would be on the Bogus Creek fireline at 8 a.m.

BIFC had been asked to provide buses to transport other crews and to supply a Finance Chief and a Time-

keeper for Bogus Creek.

"We'll have them there by noon," Parkhurst promised.

BIFC continued to get other requests for crews to be sent to other fires, for equipment, and for supervisory personnel.

Alaska was getting a flurry of new lightning-caused fires. Fires were springing up in the coastal states now: Washington, Oregon, and California. Inland, fires in Nevada and Idaho, in Arizona and Utah, were spurring fire orders to BIFC.

2:23 A.M., TUESDAY—The BIFC Dispatcher and the Forest Service Coordinator had their hands full. Their supply of available manpower, rated supervisors, equipment, and supplies had reached a critical point—but the winking lights that signaled incoming telephone calls were increasing.

3 A.M., TUESDAY—*The phone rang in Ron Kalcso's bedroom. "You better come on down," his Dispatcher advised.*

Half expecting the call. Ron was wide awake almost instantly, neither surprised nor dismayed. In 15 minutes, he was back at BIFC's nerve center, drawing a cup of steaming coffee automatically as his mind sorted through the situation in the various states, the disposition of men and material, the changes since he went off duty, the probabilities. He sifted through the fire orders now in process and advised his Dispatcher on how to handle the problems.

If a Forest Service fire is burning near a fire which BLM is handling, often a helicopter can carry supplies to one and bring equipment from the other. Keeping aircraft full on return trips, exchanging men from a contained fire to another nearby, transferring equipment directly when possible—all of these are techniques which Ron learned first as a District Fire Control Officer and then as a Fire Dispatcher.

4:30 A.M., TUESDAY—It didn't slow down any at BIFC. Alaska had some new lightning-caused fires. It was almost 1:30 a.m. in Alaska, although dawn was breaking in Idaho.

Ron still sat in, advising the Dispatcher. In fire suppression work, there's no taint of inadequacy involved in calling for a more experienced hand. That's how you learn. The Dispatcher may one day be Chief Dispatcher and be called in just as Ron was.

Back at the Bogus Creek fire, Sandy kept Larry Parry as Fire Boss until Larry had worked as long as a man could before exhaustion clouded his

ability to make decision judgments.

The Bogus Creek fire would have gotten away from any man first on the scene in like circumstances. The Dispatcher's job that became too much for Ron's relief would likely have become too much for any one man as the complications built up.

Supervisory fire personnel earn their ratings through experience as well as in schools and other training. Throughout the Federal service, the requirements for fire rating are identical: a progression through the ranks, experience on different types of fires, numbers of fires, years of experience, recent experience, kinds of experience, and special fire schooling.

No matter the branch of Federal service, a fire rated supervisor's job will be the same on any fire; each knows what to expect of the others.

8 A.M., TUESDAY—*It was 5 a.m. in interior Alaska, and Roy Percival had widely deployed his forces to battle a half dozen fires—several contained, one still a question mark, one controlled and mopping up operations underway.*

Joe Kastelic grabbed a few hours sleep at home; fire season means long hours.

BIFC met all fire orders, and Ron went back home for breakfast and the completion of his interrupted night's rest. Roland Parkhurst went home, drowsy and ready for dreamless sleep.

Sandy got some sleep after midnight, stretched out alongside some of the crews who were also breaking for a few hours of needed rest.

Larry Parry had just finished his breakfast coffee when the next contingent of crews rolled in from Burns.

So go the days and nights in fire season on the Federal lands. Some fires douse easily. Some get away from you. Some are easily handled by forces within the District. Some require help from the State organization. Some need the greater services and forces available from BIFC.

9 A.M., TUESDAY—At Bogus Creek they were seeing the beginnings of success, although the end was still hours away. The infusion of new crews, and the combined forces of District, State, out-of-state crews, rated supervisors through BIFC—all were having a controlling effect on the wildfire on the Bogus Creek drainage.

9 P.M., TUESDAY—The Bogus Creek fire was contained. They had encircled it; it wasn't out, but the weary,

blackened men knew that the fire wouldn't jump the fireline again. They had licked it, and they could eventually put it out completely.

In Alaska there were much the same problems and much the same fire suppression efforts as yesterday.

Throughout the Western States, fire suppression in a summer fire season proceeded along workday lines for the men and women in Federal service.

8 A.M., WEDNESDAY—Demanning started on the Bogus Creek fire. Some personnel remained to mop up and clean up, tear down the fire camp, and get the equipment moved out.

6 P.M., WEDNESDAY—The Bogus Creek fire was completely controlled. Mop up/clean up operations were being completed.

10 P.M., WEDNESDAY—Bogus Creek, the locale of an uncontrollable fire for 58 hours, was a blackened area of 21,150 acres. Some 1,500 head of cattle that had been grazing its pastures had been removed safely. No one in the firefighting effort had been seriously injured. The successful fire suppression had required 350 men, 3 "cats," 3 retardant aircraft, 7 pumper trucks, a catering service—and a lot of know-how from a host of sources.

Larry Parry, who had seen the lightning strike at Bogus Creek, removed his hardhat and wiped the sweatband. He settled the hat back onto his head and thought how good it would be to see his wife and children after 2½ days.

Sandy, a heavy smoker, fished out a cigarette absently and lit it as he watched the departing Larry. When the first taste came into his dry mouth, he wondered fleetingly how long it had been since he'd had time to enjoy a smoke.

Roy Percival glanced at his watch. Past dinner time in Alaska again. "A steak and some fried potatoes will taste mighty good," he thought.

In Anchorage, Joe Kastelic rubbed his bristly chin in silence. "A shave and a hot shower will put me back on top of the world—but tomorrow, the paperwork, the worst job of all!"

Their shifts over at BIFC, Ron Kalcso and Ed Heikkinen stretched and yawned. "That first cold beer—and maybe some television. Wonder if there's a baseball game on tonight?"

Roland Parkhurst, who worked the afternoon shift because it left him free to attend classes at Boise State College in the mornings, pushed back from his desk and rolled toward the elevator in his wheelchair.



Sanctuary for Pupfish



Rare desert pupfish are swimming, cavorting, and reproducing below the Bureau of Reclamation's world famous Hoover Dam — but not in the Colorado River — and the "No Fishing" sign is up.

These tiny fish, averaging less than 1 inch long, were successfully transplanted from their natural Devil's Hole habitat in Death Valley, Calif. Their new home is a spring-fed, warm-water, off-stream pool almost within the shadow of the 726-foot-high multi-purpose dam which spans the Colorado River between Nevada and Arizona.

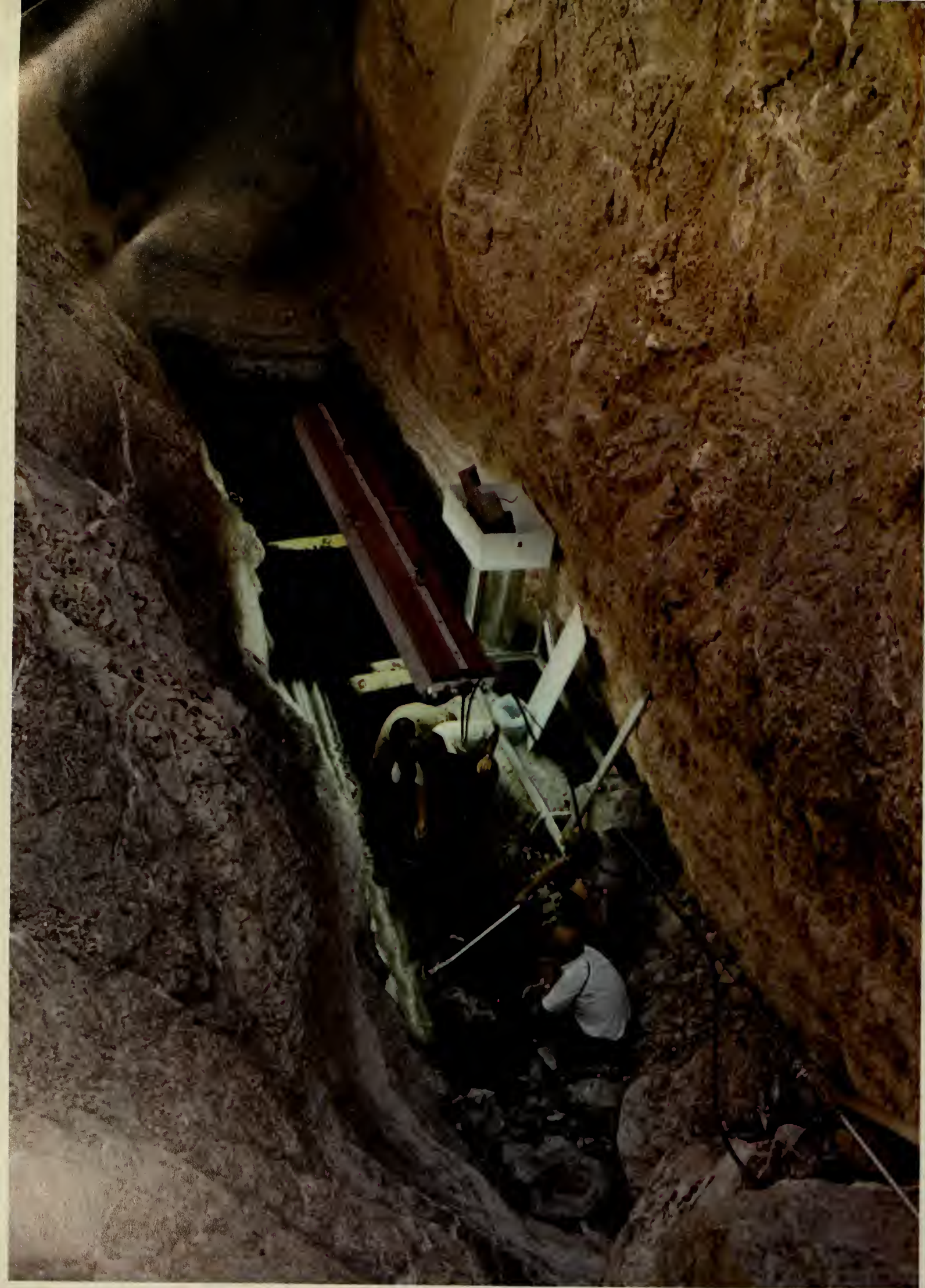
Beginning To Multiply

In a refugium duplicating as nearly as possible the conditions at Devil's Hole, the pupfish appear to be thriving and are beginning to multiply. The species, of which there are less than 300 in the entire world, are threatened with extinction in their natural habitat at Devil's Hole by a lowering water table. In their new environment below Hoover Dam, they appear to have been given a new lease on life.

The refugium is a rectangular concrete tank near the lower portal road bridge leading to the Hoover Dam powerplant on the Nevada side. It was built under contract by the Bureau of Reclamation through an agreement

(Left) Adult male and female pupfish, about one inch long, swim about in their new refugium that duplicates as nearly as possible conditions at Devil's Hole in Death Valley, California.

(Right) The pupfish refugium is located at the foot of Hoover Dam in Nevada.



with the Nevada Department of Fish and Game and the U.S. Bureau of Sport Fisheries and Wildlife. Funds were provided by the Bureau of Reclamation and the Bureau of Sport Fisheries and Wildlife.

The refugium is fed by one of the warm springs flowing out of a sheer cliff into a ravine in Black Canyon. The pond has a 10-foot deep end and a shallow shelf 3 feet deep, and is alined along the same directional axis as is Devil's Hole to provide similar sunlight exposure.

Refugium's History

The development and operation of the desert fish refugium have a brief but very complex history, dating back about 3 years. It was approximately at this time that the plight of the Devil's Hole pupfish became of prime concern to the Desert Fishes Council.

The Desert Fishes Council is a small group of scientists dedicated to the preservation of several rare and endangered desert fish of Nevada and California. The Council brought the condition of this species to the attention of the public and made the Nation aware of the need to maintain and perpetuate the pupfish.

Through this scientific group the Bureau of Reclamation became aware of the pupfish's almost certain demise if the decline of their limited habitat continued. In November 1970, Al Jonez of the Bureau of Reclamation accepted responsibility from the Council for examining the feasibility of constructing a pupfish refugium below Hoover Dam.

Pupfish's Past

The history of the pupfish extends far back into the geological history of Death Valley. Ancestors of the pupfish may have invaded the Death Valley area along the shores of an arm of the ocean which extended into the area prior to the Sierra Nevada uplift.

In any case, during the time the Sierra Nevada Range was developing, the Death Valley area received much more rainfall than it does today. This resulted in a large lake, in part maintained by the continuous flow of the Amargosa River and its tributary, Carson Slough, draining Ash Meadows. The earliest slough in Ash Meadows probably contained the ancestors of the pupfish now living in Ash Meadows.

As the Sierra Nevada Range became more effective in cutting off the clouds from the Pacific, the region slowly became drier. The drainage patterns,



(Left) A lighting system at Devil's Hole was needed to stimulate growth of algae, prime food of pupfish. (Right Top) Water enters the refugium through the deep end at right and exits through outlet weir, left. Dark green splotches are algae. (Bottom) Two adult male pupfish, distinguished from females by the dark edges on their fins.





(Left) The small light-colored object (lower left) in the deep end of the refugium is a submersible thermometer. (Right) Natural drainage from the warm springs above the refugium cascades down a ravine for nearly 250 feet before splashing into the Colorado River.

however, continued to funnel water from literally hundreds of miles away through Ash Meadows, but erosion, weathering and other geological forces gradually left Devil's Hole above surface water and disconnected from other springs in the Meadows.

Following isolation, which occurred thousands of years ago, Devil's Hole pupfish continued to adapt to their unique environment, and in the process, have come to look very different from their relatives living nearby in Ash Meadows.

Once A Warm-Water Pool

Devil's Hole evolved as an isolated warm-water pool with no surface outflow. It is located at the southern base of a low mountain ridge and lies 2,300 feet above sea level and consists of an upper pool area and a subterranean cavern system.

The upper pool reaches a maximum depth of 46 feet and the cavern system, although only partially explored, exceeds 299 feet in depth. The water in Devil's Hole is a part of the local ground-water carbonate aquifer and

the water surface is approximately 50 feet below ground level.

Conservation Agencies Assist

Throughout the past 25 years, conservation agencies have made various attempts to protect the fish. In 1952, the area was designated as a noncontiguous portion of the Death Valley National Monument and placed under supervision of the National Park Service.

Subsequently, with the increased human population and continued demand for agricultural products, areas surrounding Devil's Hole began to be developed for crop cultivation and so pumping wells to obtain ground water became necessary for irrigation.

After initiation of intensive pumping, the falling water level in Devil's Hole became evident. At this time, the Bureau of Sport Fisheries and Wildlife, along with other agencies became vitally concerned with the annual drop in the water level.

Water Drop Dooms Fish

Field studies, conducted by the U.S.

Geological Survey, were initiated and immediately related the lowering water level directly to the pumping operation. Approximately at this time the Desert Fishes Council came into being, with its initial emphasis placed on the survival of the pupfish. The U.S.G.S. Study concluded that continued pumping of ground water indicated that the water in Devil's Hole would eventually drop to a level where reproduction of this species might become impossible.

Carol James conducted research for a Master's thesis at the University of Nevada at Las Vegas, which discovered that virtually all pupfish reproductive and feeding activity was confined to the shelf just under the surface of the water. Dr. Robert Miller, of the Museum of Zoology, University of Michigan, and one of the foremost experts on desert fish, agrees with the findings of Carol James and has done additional research to substantiate her conclusions.

Upon establishing the relationship between pumping of ground water and

the falling water level; and between the falling water level and pupfish feeding and reproduction, the Department of the Interior formally requested the pumping be stopped from four critical wells. The pumping did not stop, so on July 22, 1971, the Department requested the Department of Justice to initiate litigation preventing the continued pumping of wells which influences the existing water level restricted by Federal rights. At the present time the Federal District Court in Nevada has the case under advisement.

Other Alternatives Suggested

Following the period of initial interest in this species, many other alternatives were suggested for conserving the pupfish population. These alternatives included development of an artificial shelf and lighting over the shallow shelf in Devil's Hole, transplanting the pupfish to other springs in the areas, and transporting the fish to an aquarium culture. While these alternatives were being considered, Bureau of Reclamation biologists investigated conditions in the vicinity of Hoover Dam, looking for an area to place a refugium. It was known that warm springs flowed out of the rocks and into the Colorado River in this area. Since the most favorable temperature for pupfish is approximately 92°F., warm spring water was a requirement.

The Spring Was Found

In early 1971, a spring was found below Hoover Dam which appeared to have water characteristics and temperature similar to those at Devil's Hole. Following additional investigation of the water supply and the availability of the site, a proposal to develop a pupfish sanctuary at this site was presented to the Desert Fishes Council.

After obtaining approval of the Council to proceed with such a structure, Reclamation allocated funds and assigned personnel to plan and construct the facility. With additional funds from the Bureau of Sport Fisheries and Wildlife and excellent cooperation from the Nevada Department of Fish and Game, National Park Service, and other land-use agencies, as well as the University of Nevada at Las Vegas, development of the refugium began in January 1972, and was completed in August 1972.

Substrate Is Transported

In late September 1972, the Nevada Department of Fish and Game, the Bureau of Sport Fisheries and Wildlife,

the National Park Service, and the Bureau of Reclamation gathered and transported substrate from Devil's Hole to the sanctuary. After construction was completed in late August 1972, the testing of water quality, quantity, and temperature and a thorough cleansing of the sanctuary were accomplished.

Planarians, snails, beetles, and algae from Devil's Hole were also introduced into the tank. On October 2, 1972, after 2 weeks of observation and monitoring of water chemistry and algae growth in the refugium, the Nevada Department of Fish and Game collected seven pupfish from Devil's Hole and transported them to the refugium.

A 96-hour bioassay was initiated. Two pupfish were lost shortly after transfer. However, the remaining five thrived and appeared content in their new home. Following the successful bioassay period, 20 adult pupfish were collected at Devil's Hole by the cooperating agencies and transported to the refugium in Reclamation's helicopter. One dead pupfish was removed from the refugium 2 days later. Additional planarians, snails, and beetles from the Devil's Hole area were introduced by biologists of the Bureau of Sport Fisheries and Wildlife.

Transplant Appears Successful

From October 2 through November 12, 1972, daily observations were continued to determine the survival of these fish to monitor the water temperature and breeding behavior, and to test adequately the overall operation of the refugium. By October 21, 1972, it appeared that the initial transplants were successful. In fact, biologists were pleasantly surprised to discover that reproduction was taking place in the tank. Close observation since that time indicated that several young pupfish were present.

On November 13, 1972, the Bureau of Reclamation completed its part of the agreement to design, construct, and test operation of the refugium. At that time, the management responsibility for the refugium was officially turned over to the Nevada Department of Fish and Game and to the Bureau of Sport Fisheries and Wildlife. This transfer of responsibility did not deemphasize the interest and support of the Bureau of Reclamation in the project. Reclamation intended only to avoid becoming involved in the fish and wildlife responsibilities of these agencies.

Subsequent Observations

Observations on December 1, 1972, indicated that, as nearly as it was possible to discern, all the adult pupfish were surviving and appeared to be adapting well to the conditions of the tank. At least six young fish were surviving and growing rapidly. Spawning activity was continuing and the possibility exists of additional young fish being produced during the winter months. On one occasion predation by an adult upon a young pupfish was observed.

The apparent success of the refugium is an indicator of the potential that exists, but it should not yet be considered a total success. Survival of adults and reproduction of more young through a 1-year cycle will better indicate the potential for long-term success.

Additional introduction of fish from Devil's Hole will be necessary to develop sufficient genetic heterogeneity to insure continuous vigor of the population. A major breakthrough has, however, been accomplished since this is the first habitat other than Devil's Hole in which pupfish have produced young which survived and grew for more than a few days.

May Be A Future Success

Only in the future can the refugium be considered a total success when enough young are annually recruited to sustain a reproducing population. We are especially hopeful that cropping certain pupfish in the refugium can be undertaken, to use them for experimental purposes aimed at perpetuating the species. Managing the refugium will take a great deal of time, effort, and patience from all agencies.

This 10-by 20-foot refugium, containing a few of the world's last remaining pupfish, provides a remarkable example of the cooperation that can be developed among different agencies in response to public demands. It is an outstanding example of the multiple-use concept directly associated with Bureau of Reclamation projects.

In the event that the refugium fish evolve into a subspecies, which sometimes happens when an animal is forced to live in a foreign or severely modified environment, then the refugium is not the answer for saving the remaining original pupfish (*Cyprinodon diabolis*.) If the evolution in the refugium diverges from that in Devil's Hole, other alternatives must be found to save these tiny fish.

A Ribbon On My Hard Hat

What do a geologist, a hydraulic engineering technician, a technical editor-writer, a fiscal officer, and a civil engineer have in common? Generally little, but a particular group of such individuals have much in common—they all are women and all are employees of the Bureau of Reclamation.

Therefore, those who still believe a woman's proper place is only in the home had better take a second look at what is being achieved by these females who share their talents and energies with the Bureau of Reclamation. The projects these women help design, construct, and operate have aided water users for years by developing western water and land resources.

The Geologist

A 1968 graduate of St. Louis University, Frances J. Landwehr came to work for the Bureau at Grand Coulee Third Powerplant in September following her graduation.

Since that time her work has consisted of a variety of outdoor and indoor activities. "Outdoors," explains Frances, "I work on detailed geologic investigations of the construction site and surrounding area. This includes mapping the land as excavation progresses, identifying and evaluating soil and rock types for geologic condition and content, inspecting drilling operations, and logging core. I also work on selecting base materials for fill placement.

"Indoors, there is preparation of the interpretations and exploration results. I also compile data for monthly geological and final construction reports.

"I enjoy working both indoors and outdoors. When there is adverse weather, I find something inside to do, and when the weather is nice, I look for something outside. Then there are those times when I end up outdoors in a blizzard, but that is OK, too!"

When she first arrived at the geology department, there were approximately

30 drillers and drill helpers. Most of them were apprehensive during her first day in the field, but after numerous stares and much laughter, they began to accept her. Other geologists claim they can scream for help while hanging from a cliff by their fingernails and no one will notice, but Frances stumbles and everyone looks.

"They exaggerate a bit, but I do believe I am probably one of the few geologists who can convince a driller to carry core boxes for me.

"On the whole, most of the people I associate with accept me as I am. There are some, however, who don't know I'm a geologist and wonder why I always wear jeans. One man, after seeing my desk, asked where my typewriter was.

"I get a lot of ribbing, but I enjoy the work very much. If I didn't, I wouldn't be here," she summarized.

The Hydraulic Engineering Technician

Learning why a particular canal has a 3-foot radial gate and another has a 4-foot rectangular gate, why Yuma is concerned about stormflows, and why a certain vehicle has two fan belts are only a few of the things one learns when one becomes a hydraulic engineering technician.

Ruth M. Funk, a hydraulic engineering technician in the Lower Colorado Region at the Yuma Projects Office has not only learned much from her job, but has been given ample opportunity to apply her knowledge.

The responsibilities of the Water and Land Operation Division which directly concern her include a deep-well pump drainage program. Two objectives of this program are first, to maintain safe ground-water levels in the area; and second, to coordinate the drainage flows and the salinity levels of these flows with the requirements of water to be delivered to Mexico. The drainage wells are in the Wellton-Mohawk, South Gila Valley and Yuma Mesa areas.

Delivery of irrigation water to farms on Bureau-operated irrigation systems is the third objective of the program. This includes processing water orders, preparing water delivery schedules, operating water delivery and distribution systems, and maintaining water accounting records.

Her final responsibility is involved with the maintenance of facilities at Imperial and Laguna Dams, Senator Wash Dam and Pump-Generating Plant, and Bureau-operated facilities

of the Gila and Yuma projects.

As a hydraulic engineering technician, Ruth supervises the preparation of various recurring and special reports, which include data on flow and diversion, return flows, power and operation, and a variety of hydrographic records. She prepares a schedule of water requirements for weekly irrigation for diversion at Imperial Dam for both Government and water district-operated projects consisting of approximately 180,000 acres comprised of five irrigation districts and two Bureau-operated units. She also maintains hydrographic records of daily operations by the districts and Bureau-operated units, including waste, usage, and rejected orders.

"I had absolutely no idea what the functions of the USBR were when I began working for them," said Ruth. "But, since I have an insatiable curiosity about almost everything, the Bureau opened the doors for me to a vast unknown world of maintenance, construction, engineering, irrigation, administration, heavy-duty mobile equipment, rivers, and dams. Do I like my job? Believe me—I love it!"

The Technical Editor-Writer

Filling a position that ranges from editing test plans and reports at Dugway Proving Ground, Dugway, Utah, to preparing environmental statements for each unit of the Central Utah project is an exciting career for Diane L. Jarvis.

A technical writer translates the technical language of the scientist or engineer into terms understandable to the layman. "A rewarding aspect of my job is knowing that with each finished project I've contributed to the establishment of an easier communication between scientists and engineers and laymen," commented Diane.

"My work with the Bureau has been especially interesting and challenging. With each new assignment, I'm presented with an opportunity to increase my knowledge in many categories. For example, our branch has been responsible for writing definite plan reports for the six units of the complex and multipurpose Central Utah project, Upper Colorado Region, a participating project of the Upper Colorado River Storage project.

"Another challenge is the environmental statements we have been working on which define and assess the impacts the project will have on the area's environment. Policies and



[Top] Lucy W. Pettapiece, an engineering graduate of the University of Texas, observes water flow of irrigation units near Great Falls, Montana; [Bottom] Frances J. Landwehr, a graduate of St. Louis University and one of the Bureau's three female geologists, finds her job "very enjoyable."

guidelines for these statements are in the formative stage and much of the ground work is still being laid. It is exciting to participate in this quest for quality, which is so important to present and future generations."

The Fiscal Officer

Nedra A. Blackwell, Chief of the Fiscal Services Branch in the Pacific Northwest Region, finds working for the Bureau a rewarding and challenging experience. Although most people think of Reclamation as being a man's world of engineers, the world of finance in this Region is mostly populated by women. Moreover, Nedra has the distinction of being the first female fiscal officer in the Pacific Northwest Region.

She is responsible for certification and payment of all claims for the Region and all collections from repayment contracts, and water and power sales. The payroll is also a major part of the Fiscal Services Branch and the changes it has undergone from a manual operation to data processing have been of prime interest to her. Her monthly reconciliation of fund control accounts with the Treasury Department and the Regional General Accounts Branch always presents a satisfying conclusion to the month's activity—particularly if it balances on the first try!

Whether certifying a \$4 million contract payment, a \$10 travel voucher, or attempting to interpret Comptroller General decisions, Nedra approaches each task with enthusiasm and sound judgment. "I am proud of being a part of Reclamation and particularly proud that Reclamation is one Government agency which directly benefits the people and is nearly self-supporting from the income derived from contract repayments and water and power sales."

The Civil Engineer

In 1948, shortly after the Bureau opened its Upper Missouri Projects Office in Great Falls, Mont., Upper Missouri Region, it hired a young civil engineering graduate from the University of Texas. Lucy Pettapiece has since worked on a number of assignments in that office.

Initially almost all of these assignments were concerned with bringing irrigation water to the arid lands of Montana. When she arrived, studies were in progress on the proposed Lower Marias Unit in central Montana. Tiber Dam was constructed to impound a water supply for the Unit.



(Top) Ruth M. Funk, a hydraulic engineering technician in the Lower Colorado Region at the Yuma Projects Office, has been given wide opportunity to apply her knowledge; (Middle) Diane L. Jarvis, a technical editor, facilitates communications between scientists, engineers, and laymen at Reclamation's Central Utah Project; (Bottom) Nedra A. Blackwell, chief of the fiscal services branch in Reclamation's Pacific Northwest Region, finds her work "rewarding and challenging."



However, plans for completion of the Unit had not been finalized; Lucy took part in completing them. This included laying out proposed canals and laterals, selecting structure site, preparing designs, and estimating quantities of material needed and the costs of construction.

20 Years Later

In 1968, the Bureau completed a storage dam for the Bureau of Indian Affairs 4 miles northwest of East Glacier, Mont. The structure on Two Medicine Creek replaces a dam washed out during the floods of 1964. Civil engineers, including Lucy, worked hard to obtain survey data necessary to plan reconstruction of the destroyed dam.

Runoff from a portion of Glacier National Park is regulated at Lower Two Medicine Dam for irrigation of approximately 23,000 acres in the Blackfeet Indian Reservation. Two gates in the overflow weir of the spillway release stored water for downstream diversion throughout the project area.

Other portions of Lucy's time have been spent on drafting annual construction contracts for installing buried membrane lining in canals on the Bureau's East Bench and Helena Valley Units.

This lining reduces water losses from the canals and, in the construction of drains, prevents water logging of the units' irrigated lands. New to these units, a program was started to install slipform concrete



lining in the laterals.

Now in the Design Branch of the Upper Missouri Projects Office, Lucy has been busy writing the construction specifications under which this work is performed.

In addition, she worked on studies to determine the feasibility of diverting the unused water from Tiber Reservoir on the Marias River into the Milk River to supplement supplies on the old Reclamation Service Milk River project and to provide irrigation for lands between the two rivers.

Canyon Ferry Dam is another major structure for which Lucy made preliminary studies, such as determining the back water curves of the reservoir. She also wrote specifications for removing gravel and rock fragments from the spillway stilling basin of the dam.

Lucy sees the Bureau as being far more diversified than it was years ago. "Since its beginning as the Reclamation Service, the Bureau of Reclamation was primarily interested in irrigation, with power production and flood control as byproducts of its operations. Now its goals are broadening, and irrigation is just a part of many benefits the Bureau produces.

"Among water uses to be considered are municipal and industrial supplies. Interest in developing the large coal deposits of southeastern Montana and northeastern Wyoming plunged the UMPO (Upper Missouri Projects Office) into studies of the feasibility of using large-diameter pipelines to transport water hundreds of miles from Bureau reservoirs to coal fields, where a regulated water supply is vital to development.

"As another aspect of the diversified Bureau, UMPO is evaluating the needs, resources, and development possibilities of sparsely populated eastern Montana. After development possibilities have been determined, studies will be made of methods and costs of developing these resources of which water is only one.

"This diversification of Bureau interests, in conjunction with its competent and experienced engineering staff, can lead to undreamed of new goals," Lucy adds. Far from being stereotyped, many of Reclamation's females are extremely diversified. They, as well as numerous others in different fields, all contribute to the Reclamation program. Our hats, whether hard or soft, with or without ribbons, are off to these women.

Free Spirit On The Move

We do not know the tribe of men that was first to use the horse. Scientists tell us our ancestors were eating horses long before they domesticated them. Historians affirm that horses were harnessed before they were ridden. But the first man, or even the first race of men, to do any of these things has long been forgotten.

The horse-drawn chariot dates back to 2000 B.C. in actual records, and there is evidence it had been in use for a thousand years before that. But the use of the horse as a mount did not become widespread until after 900 B.C.

We also know the modern horse evolved from the dog-sized Eohippus, and that at some point of time its ancestors found their ecological niche on the open grasslands. There they developed the specializations that gave them the speed to outrun their predators and survive.

Fossil remains of the horse and all of his evolutionary ancestors are common throughout much of North America. For many years, paleontologists believed that the horse first developed here, but later finds on the Euro-Asian continent have now raised questions about this theory. Whatever its origins, we do know that the horse either migrated to or from the western hemisphere and eventually became extinct in what is now the New World.

Spanish Conquistadors brought the horse back to the Western Hemisphere. In 1519 Cortes landed his troops and his herds of fine Andalusian horses at the site of present day Vera Cruz, Mexico, and Coronado's expedition in 1540-41 took the horse to the plains of Kansas. Through the years, some of these Spanish horses escaped or were abandoned, and these became the nucleus of the first wild horse herds in North America.

Between 1519, when Cortes landed in Mexico, and 1803, when Lewis and Clark made their expedition into the West, was a period of 284 years. In the

course of history, this is a considerable span of years—ample time to allow the great increase in the number of wild horses that had taken place by the time the pioneers began moving westward in the course of our national expansion.

Western grasslands provided an ideal habitat for the horse and, as can be expected when any species moves into a vacant ecological niche, there was a population explosion. A few horses were captured by the Indians who became expert both at hunting and fighting from horseback, but this had no significant impact on the wild horse population. By the time English-speaking settlers reached the West, the wild bands were firmly established, and it appeared they had always been a part of the western scene.

Part flesh and bone and part legend, the image of the wild horse running free on the open plains has captured the mind and imagination of modern America, and has become a symbol of the free spirit.

Occupation of the West by settlers from the States introduced new strains of horses into the wild herds. From the very first there must have been a steady stream of domesticated horses joining the wild herds, and by the end of World War I the stream became a flood. In the depression years that followed the war, many ranchers went bankrupt, abandoned their land, and turned their horses loose on the open range to fend for themselves. These abandoned animals soon became wild.

Here it is important to understand something about wildness. Any horse—whether it be a Spanish Mustang or an abandoned plow horse—is descended from domestic stock with a history of possibly 6,000 years of association with and dependance on man. But the horse, or any other domestic animal, will revert to the wild state within a few generations after escaping from human control. A domestic animal turned wild is said to be "feral," and will in a generation or two be as truly wild as though its ancestors had never known human contact. The converse is also true. The horse was probably domesticated in the first place because it was amenable to human presence and human control. After capture, a wild horse soon adapts to the presence of man and accepts the saddle or harness.

The wild bands had some practical value to early settlers. Just as the Indian had captured wild horses for





his use, settlers could also thus replenish their herds. The capture and taming of wild horses has long been a classic theme of American literature.

It is hard to say just when the local ranchers stopped thinking of the wild horse as an asset and started to consider him a pest. The change in attitude was probably tied to many things.

The population of the West had increased, and open land had started to fill up. With the coming of the automobile and the tractor, the value and usefulness of the horse decreased. In some places the wild horse became a serious competitor with domestic livestock for forage. For these and other reasons the rancher's way of looking at the wild horse changed, and between 1920 and 1960 many ranchers would shoot a wild horse on sight.

Then, during this period, another factor was added. The wild horse became an economic asset—but only after it was dead. In an affluent era, more people started to buy canned food for their pets. To meet the demand, enterprising men set up plants to process horseflesh. It became profitable to hunt, capture, and deliver wild horses to the canneries. The wild horse was then the prey of the commercial hunter.

Within a short span of years, the commercial hunter did what the rancher with his rifle had not been able to do. He seriously depleted the ranks of the wild herds in every State having open range.

The commercial hunter brought the accouterments of modern technology to the business of rounding up wild horses. The wild horse was wily and tough and knew the lay of the land. He could often outrun and outmaneuver a man on horseback, but he was not a match for motor vehicles. The commercial hunter brought in airplanes to flush the animals out of rough country and trucks or pickups to run the animals down once they were in the open. After a horse was roped, a weight was tied to the free end of the lariat, and the animal was left to wear itself out as it dragged the weight and fought the unfamiliar rope. When exhausted, the horse was loaded into trucks and hauled to the processing plant.

Commercial hunters were paid by the pound, and they had to deliver many pounds of flesh to make a living. Few felt that they could afford the extra time required to handle the

Descendants of Coronado's expedition to the Southwest plains in 1540-41, wild horses still roam freely in parts of the West. They were brought first in 1519 by Cortes, when he landed troops and herds of fine Andalusian horses at present day site of Vera Cruz, Mexico.

Here are some of the wild horses (Top and Left Bottom) that roam Bureau of Land Management's 32,000-acre Pryor Mountains wild horse range in Montana, set aside in 1968. A 1971 law protects wild, free roaming horses and burros. (Left) Famed Wild Horse Annie and friends; (Right Middle) Wild Horse Advisory Board, 1970; (Right Bottom) Another view of bleak range that is home to wild horses.



animals in a humane manner.

Let the record show that all of this was done in the name of progress. In those days, the commercial hunter operated with the approval of public opinion.

As late as 1945 the Department of the Interior's Annual Report, called the Victory Edition, boasted that 20,000 "excess" horses were removed from public ranges during that year. It went on to say, "Action under the Secretary's orders of March 16, 1943, and January 29, 1944, resulted in the removal of about 100,000 surplus horses from grazing districts and adjacent lands during the past three years. Steps are needed to encourage purchase and shipment of excess horses by appropriate agencies for food and farm purposes in devastated countries."

Let the outraged remember the words of the philosopher, "If any man ask you what is right and what is wrong, do not answer until you have asked, what time it is." Those who rounded up the horses and those who ordered or condoned it were responding to conditions and national attitudes that were far different from those we have today. The wild horse was then viewed as a serious contender for the forage needed to produce beef for a hungry world.

At first, the abuse of captured horses concerned only a small group of people. But in time this group grew in number, and their protests eventually attracted national attention. One of the early protesters was a Reno, Nevada, secretary named Velma Johnston. No one who knows the story of Mrs. Johnston could ever contend that one person cannot change conditions they do not like.

Mrs. Johnston's campaign on behalf of the wild horse began in 1950 after she first saw the abuse suffered by horses in the process of roundup and transportation to slaughter. Nine years later, she appeared before the House Judiciary Subcommittee to testify on behalf of a bill being introduced by Congressman Walter S. Baring of Nevada for the protection of wild horses on public land. Her testimony was based on more than nine years of personal research, investigation, and effort. She made two extremely telling arguments:

1. The efforts of the commercial hunters had so reduced the population of wild horses that they were no longer a significant competitor to domestic livestock for public land forage.
2. The inhumane methods used to

capture and transfer these horses were an affront to humanitarian values.

The story is told, that during the time Mrs. Johnston was testifying in favor of the Baring Bill, a critic slightly referred to her as "Wild Horse Annie." Mrs. Johnston overheard the remark and adopted the nickname. Today many people know her by no other name than "Wild Horse Annie."

The Baring Bill, often called the "Wild Horse Annie Act," became the first Federal legislation designated for the protection of wild horses and burros. Basically it prohibited the use of any motorized vehicle in chasing, harassing, or capturing wild horses on public land. It provided the only Federal protection the wild horse was to have for 12 years.

In retrospect, we know that the bill had two basic weaknesses.

1. It failed to establish a legal status for the wild horse.

2. It failed to provide a program of management for the animals.

Because the horse was a feral animal, it had no protection under the game laws of the various states. Because it had escaped human control and was unclaimed, it did not fall under livestock regulations. There was nothing in law to determine whether the animal was the responsibility of the Federal Government or of State government. Thus, for years the status of the wild horse remained in limbo.

Since the horse had no legal status, the Bureau of Land Management had no authority to make allotments of forage for its use. Neither could the Bureau make any other provisions for its needs.

In response to public interest generated by a national magazine article and other publicity that followed, the Secretary of the Interior authorized the Bureau to set aside 32,000 acres of public land in the Pryor Mountains as a wild horse range. This was done in 1968.

To assist in developing management policies for the range, the Director of BLM appointed a committee of prominent citizens, including Wild Horse Annie, to advise him on the management of the Pryor Mountain herd. The Committee made a series of recommendations which were adopted by the Secretary in 1969.

To keep the horses on the range and the cattle off, the Committee recommended that BLM fence the Pryor Mountain Range. Within it, the horses were free to roam at will; however, the enclosure would also

prevent the herd from moving into new territory which in a natural situation would be the herds means of counter balancing its own population pressures.

One of the first problems faced by BLM in the management of the Pryor Mountain herd was the fact that the range was over-populated. The horse, like any animal on a limited range, has the reproductive capacity to outrun its food supply. Once this point is reached, the animal literally starts to destroy the environment that sustains it.

The biological wisdom that is inherent in this high reproductive capacity is negated when artificial factors are introduced into the animal's environment. In a completely natural environment, for example, the horse is preyed upon by a variety of carnivorous animals and is beset by disease and harsh climate. Under these natural conditions, mortality is high and the chances are relatively low for any single individual to reach the age when it can reproduce. A high reproduction rate is nature's way of offsetting losses from natural causes.

When man enters the picture, his best intentions often do as much harm to nature's balance as his worst depredations. It was this kind of situation that had developed in the Pryor Mountains by the autumn of 1971. Man had eliminated all natural predators and also the diseases that might afflict horses in the wild. With natural population controls removed, the herd now faced a more serious and more deadly threat: overpopulation, and stemming from that somewhere in the future, starvation.

Biologists estimate that the Pryor Mountain range produces enough forage to feed about 85 horses. At this level of population, the horses would be able to go into the winter in good condition and the majority could be expected to survive the harsh winters that are common in that area.

But in the fall of 1971 there were approximately 160 horses on the range—roughly twice its carrying capacity.

One of the insidious things about overpopulation is that its harmful effects are not immediately apparent. To the untrained eye, things may look good at first. There are a lot of animals, and they seem to be in good condition.

The real danger signals are subtle and difficult to detect.

The plants that sustain grazing animals, have adapted themselves

over the years to the periodic loss of a part of their foliage. When a grazing animal takes a bite of grass or leaves, the plant has a reserve of tissue and energy that enables it to recover and replace the lost foliage in due time. This situation prevails to the benefit of both plants and animals on a balanced range.

But when too many plant eaters dine too often, the animals start to consume the reserves that the plant needs to restore itself. In short, the plant is nibbled to death. The first thing that happens on an overgrazed range is the disappearance of the choice forage plants. These are the plants that the animals like best and eat first. They are sometimes referred to as "ice cream plants" by range managers. As the ice cream plants disappear, less palatable plants take their place. To the untrained eye, the range still looks good. It is green and there is lots of vegetation, but to the range manager—who must look at the range through the eyes of the horse—pickings are increasingly slim.

After a time the horses start to eat the less palatable plants. At this point the situation is closely akin to the child who eats spinach only because there is no pie on the table. As the range continues to deteriorate, the animals are forced to become less and less choosy about what they will eat. More important, many of the plants they now consume to satisfy their hunger are low in nutritional value. The animals start to show signs of malnutrition, and as the overgrazing continues the vegetative cover of the soil is depleted to the point that the soil begins eroding.

Yet, even on a severely overgrazed range, it is only rarely that an animal lies down to die of simple starvation, and even more rarely is the range manager who has warned of the situation vindicated by something as dramatic as mass starvation. Instead, the weakened animals become more susceptible to disease. An infection that healthy animals might throw off may become fatal to the undernourished, and a cold spell or rainy season that would be only a minor inconvenience to healthy animals may decimate a herd weakened by prolonged hunger.

The disaster that has hovered on the horizon for so long may at last strike like lightning but chances are it will be misinterpreted as something else. The public rarely understands what happens. Newspaper stories tell of spizootics or of winter-kill, but often the real killer is overprotection.

So it was that in 1971 the Pryor Mountain herd was threatened by its own numbers. There was widespread public concern about wild horses in general and about the Pryor Mountain herd in particular. Because of BLM's earlier efforts to have the horses removed from the Pryor Mountain range, many people were led to believe the Bureau had intended to sell the horses for dog food. In the ensuing public outcry, BLM's Washington and Montana offices were swamped with mail and TV networks and newspapers were reporting any event pertaining to the herd. While most of the media made a conscientious effort to provide fair coverage, carefully assembled biological data were often smothered by the sheer volume of dissenting opinions that had to be represented in the news stories. In this climate of public opinion, BLM gingerly approached the problems of overpopulation and the obvious need to reduce the herd.

After full consultations with the Study Committee, local citizens, and concerned national organizations, BLM decided to remove as many surplus horses as possible by a roundup.

With a crew of seven men and a remuda of 20 horses, the roundup crew spent 18 days in the saddle and removed 46 animals from the range. Of the 46 horses removed, 16 colts were delivered to WHOA, a national organization dedicated to the protection of the wild horse, at Lovel, Wyoming; 28 studs were delivered to the Crow Indian tribe at Pryor, Montana; and two branded horses were returned to their owner. From 120 to 130 horses were left on the range.

In retrospect, BLM officials concede that the 1971 roundup was a stopgap measure and only a partial success.

- It did defer to the popular will by reducing the herd without the sacrifice of animals.

- It did reduce the herd to a point where the remaining animals could survive the winter.

- It did not reduce the herd to the level necessary to bring grazing pressure into balance with the carrying capacity of the range.

- It did not establish a workable procedure that can be followed in future years for the sound management of the herd.

At some not-too-distant point, BLM and the public will have to bite the bullet of reality and decide that some

horses will have to be sacrificed for the good of the herd.

In 1971 Congress showed its continuing concern and recognized a deep interest on the part of the public for the wild horse by enacting additional legislation for their well-being. Public Law 92-195, also called the Wild, Free Roaming Horses and Burros Act, was signed into law by President Nixon December 15, 1971, and brought a new concept to official attitudes toward wild horses on the public range.

First, it established the legal status of wild horses by making them the official responsibility of the Federal Government. Specifically, wild horses on National Resource lands would be the responsibility of the Secretary of the Interior through the Bureau of Land Management, and those on National Forests would be the responsibility of the Secretary of Agriculture through the Forest Service.

Second, it decreed the horse an integral part of the natural system and bestowed its right to a place in the ecology of the range. Now the managing agencies could allot a part of the public range forage for the use of the wild horse.

Third, it eliminated any possibility of making a legal profit from wild horses by prohibiting their sale.

Fourth, it extended and strengthened provisions prohibiting capture, branding, harassment, and death of any wild horse on public range.

Fifth, it established an Advisory Board composed of prominent private citizens who are charged with responsibilities for advising both Secretaries on matters concerning the management and protection of wild horses.

Since passage of the Act, members of the Advisory Board have been named and a charter has been adopted for their operation. The two Departments have also adopted proposed regulations to implement the new Act.

The new law looks far beyond the Pryor Mountain Range. It provides for protection of the horses wherever they may be found on public ranges and provides for a system of range management that recognizes their presence. BLM officials foresee many problems ahead and predict that even more legislation may be needed in future years. But they also believe that at last the place of the wild horse on public land has been firmly, and rightfully, established.

People Need Their Forests

Diverging shafts of sunshine pierce the early morning haze drifting through a tall forest on the western slope of the Cascade Range in Oregon. A blue grouse whirs into the air in front of a boy and his father hiking along an old skid road, and a black-tailed deer turns quizzically from its feeding and then trots away. Mature timber, grown tall and old with time, was harvested in this part of the forest only a few years ago, and already growing in its place is another generation of trees with the fresh, vigorous look of youth.

"I bet this is the biggest forest in the world, huh, Dad? I hope we keep coming here forever."

"Forever? Well, as long as the forest is here."

"Won't that be forever?"

"I don't know, son — but why not?"

People have loved their forests from the beginning of humanity. They've needed their forests, and they've used them. But it has only been during the past 500 years or so that they have really thought much about the future of their forests.

Even now it does not always occur to people to appreciate all the benefits that forests provide. Forests furnish people with two kinds of environmental quality: indoors and outdoors. There's the kind of friendly and essential environment that products of the forest provide in the homes, schools, churches, offices, and stores of our communities.

People also depend on trees — without giving it a second thought, generally — for lumber, plywood, laminated beams, sheets of wood fabricated from large or small particles, furniture, newspapers, tissues, insulation, mulch, and packages of every conceivable size, shape, and design. Wood even produces an increasing variety of chemicals that enhance the human environment. Other products of the forest include Christmas trees and greenery, nuts, pitch, arrow stock, poles, posts, ferns, moss, and evergreen huckleberry for the floral trade, shingle bolts, and fuelwood for a crackling fireplace on a cold night.

Forests enhance the outdoor environment with a similar versatility. They regulate the flow of water for domestic, industrial, agricultural, and recreational use. They provide the habitat needed by many kinds of wildlife, and they provide forage for livestock.

People enjoy forests. They may only drive through on a paved highway, or they may back-pack to more slowly absorb esthetic refreshment. Family camping and picnicking attract increasing numbers of forest visitors, most of whom are genuinely interested in the workings and well-being of the forest. Others prefer more wide-ranging activities such as rock-hounding, mountain climbing, hunting, fishing, snowmobiling, horseback riding, cycling, skiing, and other vigorous forms of outdoor recreation.

Is the urge to get outdoors, a call from one's past, or is it simply necessary to occasionally escape the bonds of tightly controlled urbanity? Whatever it is, people need some elbow room once in awhile, and they often look for it in the forests.

As managers of the National Resource Lands, including those that are forested, the people of the Bureau of Land Management walk the ridgepole between tradition and innovation. Centuries of past experience have been transformed into laws, regulations, and guidelines. But it is also necessary to look ahead. There has never been so dynamic an era as now, and the needs of the future must be anticipated today.

As might be expected, the rules for resource management develop slowly, and usually they change slowly — generally after forward-looking practitioners have proved the values of new techniques. Legislation tends to coordinate the realities of people's wishes. The job of the rulemakers, then, is to determine not only what people's wishes are, but what they will be.

The Bureau of Land Management has long been in the forefront in recognizing the desirability of public involvement in deciding how natural resources are to be managed. For almost 40 years, advisory boards have consulted with the Bureau. They have jointly struggled with the current practicalities of making resource management decisions while recognizing that their actions probably would influence the distant future.

With resource management, it's that way. For every action there is a

long chain of reactions. District advisors help apply policies to local issues, and sometimes discover that policy revision might be appropriate. Each of BLM's ten State Directors in the West consults with a State multiple use advisory board. In western Oregon, the O&C Advisory Board also is available to help BLM plan to manage the wealth of forest resources.

Federal agencies also encourage the public to become involved in a variety of ways: become informed, seek law enforcement, make legislative wishes known, establish priorities, secure funds for the implementation of desirable policies, organize for greater effectiveness, and participate in public meetings.

However the public becomes involved, a crucial point for both the public and public agencies to remember is that the time to mold policies is while they are still pliable. Early involvement is the key to success, and it is the day to day interaction between people in and out of government that most harmoniously promotes an exchange of ideas and the realization of the best courses of action.

Such involvement, preferably on the ground where the situation can be studied first-hand, allows the agency representative to learn of the interests and wishes of the public representative. At the same time, the professional knowledge of the resource conservationist will help promote better understanding of alternatives.

It takes many professional skills to supply people's needs from the forest. For example, managing the forest resources of the National Resource Lands requires foresters, silviculturists, forest engineers, cadastral engineers, civil engineers, forest hydrologists, soil scientists, fishery biologists, wildlife biologists, recreation planners, economists, statisticians, realty specialists, mining engineers, land use planners, and other experts with bachelor's, master's, and doctor's degrees.

How do resource management professionals and resource users get together on a person-to-person basis?

A company forester says to a BLM forester, "I saw some red-topped trees that the bugs killed on the South Fork of Daisy Creek. How soon do you think you can put up a salvage sale?"

A fisherman remarks, "You know that gravel bar that formed behind the gabions you installed last summer on the Siuslaw River? Well, I saw six

salmon spawning there the other day. There are a couple of places over on Drift Creek where I believe the same thing could be done."

A member of the Appaloosa Club asks, "Could our members clear a parking area and build a loading ramp on Copper Creek so we could go horseback riding on the logging roads in that area?"

A member of the environmental council reports, "I noticed a couple of culverts spilling onto the fill on the Smith River road. They ought to have half-rounds to lead the water down the slope."

The interchange is endless. Out of it comes ideas, moderations in approach, more complete information, cooperation, and better resource management for the forests of the National Resource Lands.

From the tall timber of the southern Alaskan coast to the smaller sized spruce stands north of the Arctic Circle, there are millions of acres of forests in the 49th State for which the Bureau of Land Management is responsible. The uses to which these northern forests are and will be put are many, requiring careful planning for optimum benefits.

In the lower 48 states, BLM manages about four million acres of forest land on a sustained yield, multiple use basis to produce maximum public benefits. About half of this acreage is in western Oregon and the other half is scattered throughout eastern Oregon, Washington, Idaho, Montana, Wyoming, Colorado, New Mexico, Arizona, Utah, Nevada, and California. Also in the same states, BLM manages about 23 million acres of woodlands which are used chiefly for wildlife cover, watersheds, recreation, and other purposes. During this decade, these tree-bearing lands will be reinventoried to determine kinds of timber, quantities, and rates of growth. Potential uses in addition to timber production will be studied, as will the environmental impacts of the present custodianship versus more intensive management. National Resource Lands in Montana, California, Colorado, Wyoming, Idaho, eastern Oregon, and New Mexico are the first on which forest resources are to be reinventoried.

In contrast, the BLM forests in western Oregon have been managed with increasing intensity since the passage of the O&C Act in 1937 which called for the management of lands revested from the Oregon and

California Railroad. That was the first Federal law to prescribe sustained yield, multiple use forest management.

Following catastrophic timber losses from the Columbus Day windstorm of 1962, the Christmas-week floods of 1964, and the Oxbow burn of 1966, BLM forests in western Oregon were reinventoried and new harvest levels established in 1971. Policies to be followed in determining the allowable cut and in giving full consideration to environmental requirements were jointly developed by BLM experts and non-government advisors. An allowable cut policy committee of the O&C Advisory Board met on numerous occasions in 1966 and 1967 to study the information and recommendations that were received from knowledgeable public and private representatives. The committee's report provided the basis for the guiding principles that were finally incorporated in BLM's timber harvest plan.

Of a total of 2,391,000 acres of National Resource Lands in western Oregon, 1,810,000 acres of forest land are available for timber production under normal cutting practices. Modified timber cutting is conducted on 154,000 acres, and no cutting is done on 427,000 acres. Excluded from cutting are 270,000 acres of land not physically capable of sustained timber production and 108,000 acres of damageable watershed. Lands capable of commercial timber production, but from which cutting is either excluded or limited, total an additional 203,000 acres. In summary:

Resources Benefitting From Timber Cutting Limitations	No Cutting (Acres)	Limited Cutting (Acres)
Recreation sites	15,000	39,000
Streamside buffers	15,000	32,000
Scenic areas and roadside buffers	19,000	83,000
Watershed	108,000	—
Non-forest	270,000	—
Sub-totals	427,000	154,000

Thus, timber harvest from National Resource Lands in western Oregon is categorized as follows:

	Acres
Normal timber harvest practices	1,810,000
Harvest modified to protect other resources	154,000
Protective forest reserved from harvest	427,000
Total	2,391,000

Computerized predictions, incorporating scientific data and publicly developed policies, indicate that currently proven timber growing practices will yield sustainable harvests of 1.172 billion board feet of timber each year. Consequently, BLM timber sale plans in western Oregon are designed to achieve an average annual harvest of this size.

In the meantime, there is the possibility that scientific research and new technology will produce more timber and allow even bigger harvests in the future.

More wood will be needed by people as time goes by. Even though the rate at which the world population redoubles may be slowed through both wisdom and competition, the standard of living of much of the present population should be raised. Urging the use of wood substitutes is not the total answer. The manufacture of most of the suggested substitutes requires such large amounts of energy that this could compound environmental problems. The most practical answer seems to be to produce timber as efficiently as possible on all lands that can be properly devoted to that purpose. Timber production, however, is only one of the many uses of forest lands, a fact that clearly emphasizes the need for wisely managing all forest resources.

Current forest management as practiced by BLM is designed to efficiently produce timber, to protect environmental quality, and to give due consideration to other uses of the forest. Equally important, people are recognizing that they can help shape resource management policies by working with agencies like the Bureau of Land Management. Although forest lands are finite, there will always be opportunities to improve the management of the forests and their resources, and to enhance the quality of the environment for all people.

"Dad, why can't the forest be here forever?"

"It can, son. All we have to do is take care of it."



Canal for Irrigation- And Salmon

It is well known that water development features on streams where salmon ascend to spawn may seriously threaten and sometimes end such runs. Special devices such as screens and fish ladders have been used to preserve the salmon runs.

Now the Bureau of Reclamation has a 3½-mile dual purpose canal which not only supplies irrigation water but has deep gravel beds for salmon spawning. The relatively slow water, however, does not quite equal a natural stream and silt would settle over the salmon eggs and small fry, smothering them except for a new gravel washer.

The gravel washer is a gargantuan machine which rides on rails and reaches across the 140-foot-wide Tehama-Colusa Canal in California. As the washer slowly creeps upstream, a baffle hanging in the water accelerates the flow and directs it across the gravel bottom to stir up and flush away any silt.

The cleaning rig may also be used to clean out hollows in the gravel where spawning salmon may rest on their way upstream and, after spawning when the adult fish die, the device will sweep out fish carcasses. Later, fingerlings will be directed by bar screens on the gravel washer toward safe exits to the sea.

Oxygen-rich water from nearby Shasta and Trinity Reservoirs, features of the Central Valley project, is released into the 6- to 8-foot deep concrete-lined canal. Carefully selected gravel about 2 feet deep lie on the bottom, creating spawning beds.

Worked out carefully with the Bureau of Sport Fisheries and Wildlife and California State scientists in cooperation with Reclamation engineers, the artificial spawning beds may serve salmon better than natural streams.

Fishery biologists will select prime salmon attempting to reach former upstream spawning areas, and these selected salmon will be the first permitted to enter the new beds. Biologists expect that an attractive breed of "Tehama-Colusa" salmon will result.



Salmon fingerlings are apparently "imprinted" by the quality of water so they will return from the Pacific in 3 or 4 years as adults to seek the precise areas in streams where they originated. This will bring an estimated 40,000 salmon a year into the canal, to lay 140 million eggs. A tremendous attrition occurs in the salmon—in the stream as fry and fingerlings, while they are at sea, and from fishing while the salmon are migrating upstream—so that natural selection tends to evolve a highly perfected strain of fish.

(Top) Dual purpose Tehama-Colusa Canal in California, 3½ miles long, supplies irrigation water and provides deep gravel beds for salmon spawning. (Bottom) Fish grader or selector facility. Canal is designed to convey 2,500 cubic feet per second of irrigation water and provide over two million square feet of salmon spawning habitat.

Water for Coalinga

For more than 85 years, residents of Coaling Station A (which today is Coalinga, California) could not cook with or drink locally obtained water. It was full of corrosive salts.

Even washing windows with the water etched the glass.

Before "Coaling A" was incorporated, good water was wheeled in by horse-drawn wagon and delivered to homes. In front of most houses stood an 80-gallon wooden barrel from which residents scooped up a bucketful to meet daily needs.

Later, drinking water was brought in by railroad tank car. For a time some water was obtained from deep wells. This was augmented in 1959 by water treated with a reverse osmosis experimental plant. Most householders put in auxiliary water pipes and drew their drinking water from a third faucet at the sink. However, even as recently as a couple of years ago some residents filled their water bottles at 7¢ a gallon at a water filling station run by the town.

Today this town of 7,000 people in Fresno County has a supply of potable water brought in by the Bureau of Reclamation.

This happy result was not predicted by men of the old railroad. As the oil wells which originally brought residents to the area began to be pumped out, the railroad men laid bets that Coalinga would soon become a ghost town.

But the area around Coalinga had the world's largest supply of asbestos and some of the Nation's greatest resources of commercial chrome, magnesite, manganese, mercury, and gypsum. It was also the source of the State's best reserve on the west side of the San Joaquin Valley of aggregate meeting specifications for reinforced concrete.

Finally, farmers even learned how to irrigate with the saline waters. They grew salt-tolerant crops such as tomatoes by mounding up the soil in rows and growing vegetables on the crests. Heavy salts tended to leach away from the root zone.

Instead of becoming a Death Valley, Coalinga prospered in spite of a poor and unreliable water supply.

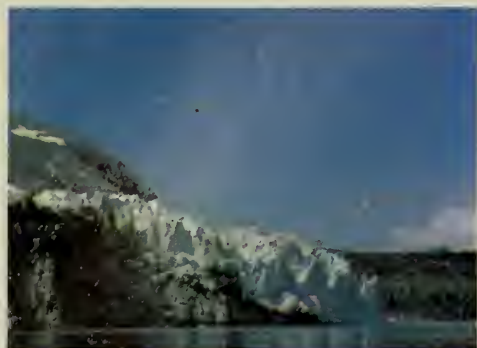


With the advent of the Central Valley Project of the Bureau of Reclamation came the promise of fresh water irrigation supplies and potable domestic water. Upon construction of the San Luis Unit and its Coalinga Canal and Pleasant Valley pumping plant, Coalinga said goodbye to "poisonous" water and celebrated with a Water Festival. In April 1972, the Commissioner of Reclamation participated in these ceremonies and helped dedicate a splashing water fountain and pool in the center of town.

The Coalinga water supply and the San Luis Unit resulted from direct participation and support of the people on the western side of the San Joaquin Valley. It is another positive example of planned development of water supplies to conserve and enhance environment for people.

(Top) Pumps lift water from Coalinga Canal for Coalinga, California; (Left Middle) When a resident drove to a service station and yelled, "fill 'er up," he meant drinking water, not gasoline; (Right Middle) the B.F. Sisk Fountain; (Bottom) fresh water — abundant enough to play in — was dream of Coalinga townspeople.

Glaciologists At Work



From the remote, frozen lands of central Alaska to the scenic wilderness of Mt. Rainier, Washington, a separate group of U.S. Geological Survey scientists-glaciologists are hard at work studying ice masses known as glaciers.

Some 10,000 years ago, coinciding with man's emergence from the Stone Age, much of the earth's surface in the Northern Hemisphere was emerging from under vast sheets of glacier ice. The indelible evidence of the glacier's power is still apparent today in most populated regions of the world. This is not the first nor is it likely the last time that glacier ice has dominated the earth.

Unlike our forebears who followed the retreating glaciers across Europe to North America, we are now studying the forces which cause such monumental changes on our planet.

Because a strong resurgence of glacier growth—or the dwindling of existing glaciers—would have catastrophic effects on the habitable areas of our now crowded world, we must understand the causes of glacier fluctuation and devise ways to make them work for, rather than against, the earth's inhabitants.

Glacier ice now holds in storage nearly 80 percent of the world's fresh water. Most of the ice is in the ice sheets of Antarctica and Greenland which, because of their immense size, have profound effects on the world's climate. Glaciers cover 17,000 square miles of Alaska and furnish an important source of fresh water runoff in the States of Washington, Oregon, Montana, and Wyoming. It is in these areas that the Survey's glaciologists go about their work.

Their various studies are aimed at determining the extent of the glaciers, gaining insight into the dynamics of glaciers, understanding their inter-relationships with weather and stream runoff, defining hazards presented by "surges"—fast unpredictable advances, and outburst flooding.

The Survey's glaciologists use a variety of methods to probe the icy glacier environments. Often arduous studies on the glaciers, such as South Cascade and Nisqually in the State of Washington, are made to gather detailed information on the structure and flow properties of glacier ice and measurements of annual snow accumulation. Other studies rely on satellite investigations of large-scale changes in glaciers in remote areas and for detecting glacier surges. Aerial surveys are another tool used by glaciologists to monitor changes in glacial activities.

The end results of these studies reveal significant information about the volume and nature of glaciers of the world, the flow properties of normal and surging glaciers, and the effects of glaciers on climate and their responses to climatic change. Glaciologists of the Survey are learning more about glaciers' unique properties as natural reservoirs, which automatically store water during cool seasons and years and release water during warm dry periods and counteract the imbalances of annual rainfall fluctuations. Knowledge gained from these studies has a practical advantage, for example, when planning hydroelectric projects and controlling artificial reservoirs.





The study of glaciers is an immensely important science to man as he plans for the future. About 10,000 years ago, as people emerged from the Stone Age, the Northern Hemisphere likewise was emerging from vast sheets of ice. U.S. Geological Survey scientists-glaciologists are busy from central Alaska to Mt. Ranier, Washington, studying vast ice masses. (Top) A scientist checks a special precipitation gage at Gulkana Glacier in Alaska; (Left Page 92) views of two glaciers in Alaska; (Left Bottom) a scientist measures glacial ice; (Right Bottom) a glaciologist surveys flow of black rapids glacier in Alaska.



Mapping Frozen Antarctica



U.S. Geological Survey scientist surrounded by flags of Atlantic Treaty signators at the South Pole.

Each year since 1957, topographic engineers of the U.S. Geological Survey invade the most hostile region on planet Earth—Antarctica. Their mission is to establish geodetic control to support the mapping needs of the U.S. Antarctic Research Program. Their assignments often take them to areas where man has never set foot.

Surveying in unmapped territory, hundreds of miles from established bases, with contact possible only by portable radios, offers much excitement and challenge. Living in tent-camps, mostly on the move along the treacherous icy terrain, cooking one's own meals, and encountering extreme weather conditions from sub-zero temperatures to complete "whiteouts" is the likely day-to-day experience for the topographic engineers.

What kind of men volunteer for such assignments? Perhaps they are men not unlike yesteryear's pioneers of the Old West because Antarctica remains the only virgin wilderness on Earth. There are still unexplored and unmapped territories in the Antarctic and man's very nature calls him to the challenge.

One difference between the topographic engineer and the Old West pioneer is that the engineer is better equipped for his assignment. He is better trained, has the advantage of better clothing, proper shelter and food and knows exactly where he is and what lies ahead. He has the best surveying instruments that modern technology can offer and can communicate with permanent bases in case of emergencies.

However, all the "niceties" and modern equipment do not remove the hazards of extreme cold and treacherous terrain. The skill and cunning demanded for survival in Antarctica probably equals that needed by America's greatest pioneers. Antarctica still beckons for our engineers to unlock her secrets. Although millions of square miles of Antarctica have been mapped by Survey engineers, more than two-thirds of the continent remains unmapped.

The USGS engineers have played a major role in the scientific investigations of Antarctica and have aided an international research effort to learn more about this remote continent. They have left their mark and many have been rewarded with having Antarctic features named after them: Pecora Escarpment, Whitmore Mountains, Mount Radlinski, Lyddan Island, Mount Southard, Mount MacDonald, Mount Chapman, Bermel Escarpment, Lake Brownworth, and many others of which the Department of the Interior is equally proud.

Mapping of the frozen continent first begins with the topographic engineer on field assignment. His work includes long tedious days on traverses with the transit or Electrotape, countless hours of flying aerial photography, days expended inspecting and analyzing the photography, and computations of the field control data. Back in the States, a select group of cartographers and technicians transform the field data into maps portraying Antarctic features. These maps are accurately printed in color and made available to scientists and the public. The sources and techniques used to date have yielded quality map products.

New map sources and techniques are on the horizon. One presently being tested is the all-weather, all-season, Doppler satellite tracking equipment which has been tested by engineers in Antarctica. The initial results prove that this equipment will provide accurate geodetic positions and will operate in the extreme weather conditions of the polar regions.

Conventional aerial photography, at least for exploratory and small-scale mapping, is giving way to the new imagery being collected by the Earth Resources Technology Satellite (ERTS-1). Such new space-age technology may help to make the dreams of our engineers of mapping the entire frozen continent a rapid reality.

Benefits From Water Research

Americans use water profusely. It takes about 130 gallons each day to supply one person with enough water to drink, cook, bathe, wash his car, sprinkle his lawn, cool his home, and obtain the countless industrial, agricultural, government and business products and services which he requires.

Although Interior's water research programs may seldom touch the average person directly, results of these programs affect the lives and well-being of millions of our people. Through the Office of Water Resources Research, Interior administers a nationwide cooperative research and training program under grants and contracts.

OWRR emphasizes geographic areas—where urgent water problems exist or may occur, or where there are gaps in the Nation's water research effort. It focuses on "real-life" water problems. In 1972, more than 1,700 professional investigators and 2,200 student research assistants were active in nearly 1,000 OWRR-supported projects. Participating in the research were 148 universities and colleges, 28 private and commercial firms, 10 public agencies, and eight non-profit organizations.

Water problems occur in metropolitan areas, in suburbs, in rural areas, in forests and watersheds, on Federal and Indian lands—just about everywhere. The problems can be of strictly local interest or of national concern, such as when a disaster occurs. But in OWRR's programs, one principle applies universally: All resource findings are made available to the public. These findings help people across the land.

An example of how an OWRR study resulted in practical solutions for a common urban drainage problem is provided through the work of Herbert G. Poertner, a private research engineer of Hinsdale, Illinois. Runoff in heavily populated urban areas from severe storms causes damaging floods and adds to pollution of our waterways. Poertner believed that such

damage could be reduced by allowing water to accumulate in normally unused water-storage facilities such as abandoned quarries, large underground pipes or tanks, residential lakes and recreational areas such as parks, ballfields and tennis courts. By using such potential storage areas, runoff water would not be dumped all at one time into drainage collection systems to clog and overrun their capacities.

Poertner submitted a proposal and obtained OWRR funds to investigate his ideas on a local scale for reducing water runoffs from storms. The American Public Works Administration furnished him with data from 176 public agencies and 40 engineering firms on the requirements, experiences and practices involving on-site water detention. Based on this data and his own investigations, Poertner prepared a report showing the benefits, limitations, and legal aspects of on-site water storage. The APWA Research Foundation is assisting with dissemination of his findings by publishing a special report for the use of its 12,000 members in solving water drainage problems nationwide.

Poertner described how one community tackled a drainage problem which occurred at Oak Lawn Creek in southern Cook County, Illinois. A park area along the creek was excavated and graded to retain runoff waters from an adjacent urban area. The excavation has proved effective not only in reducing local flooding in the developed properties along the creek, but it also serves multiple recreation needs, including ice skating in winter.

Another example is the Melvina Ditch Detention Reservoir near Chicago, constructed in 1968 at a cost of \$900,000 by the Metropolitan Sanitary District of Greater Chicago. The basin, 21 feet deep and covering 11½ acres, serves a four-square-mile drainage area and can accommodate runoff from a 10-year storm. After completion of planned improvements of the drainage ditch downstream from the reservoir, the system should be capable of accommodating runoff from a 100-year storm. A pumping station can empty the full basin in 12 hours. Excavated material forms a mound which is used for sledding and skiing in winter, while a concrete paved area in the basin is used for basketball and volleyball as well as preventing erosion. An alternative design involving construction of adequate storm sewers



would have cost \$1 million more to build — more than twice as much as the system that was developed — and would have provided no recreational benefits.

The New Jersey Water Resources Research Institute at Rutgers University is representative of institutes approved in all the States and Puerto Rico to conduct research authorized by the Water Resources Research Act of 1964. The Institute Director, Brig. Gen. William Whipple, Jr., USA-Ret., has stimulated development of artificial aerators for adding oxygen to polluted rivers, thereby supplementing the secondary treatment of waste discharges and improving water quality.

The Institute's research, carried out with OWRR assistance, now is being applied in areas far from New Jersey, including the Miami (Ohio) Conservancy District and the Metropolitan Sanitary District of Chicago, both of which are designing prototype installations of aerators. By helping one State with a research grant, OWRR thus makes improvement of water quality possible in many States.



The search for clean water never ends. (Left Top) an OWRR grant assisted Quinault Indians in Washington State; (Left Middle) cleaning Madison, Wisconsin's Lake Mendota with a harvesting machine; Right (1) researcher working at Rookery Bay, Florida; (2) oxygen being added to polluted river in a New Jersey project; (3) scientists investigate effects of thermal discharges on fish in Missouri; (4) earth mound taken from Melvina Ditch Detention Reservoir is used for skiing and sledding in winter.

OWRR also supports studies to determine the effects of hot water discharges from power plants on under-water life. According to one estimate, as much as one-half of the total available runoff in the continental United States will be required for cooling water by the year 2000.

Among scientists investigating the effects of thermal discharges on fish are Drs. Robert S. Campbell and Arthur Witt, Jr., of the University of Missouri. Working at the Thomas Hill Reservoir in Missouri, where heated water from a fossil-fueled power plant enters the lake, researchers found little biological damage and even discovered improved fishing at times. They suspect, however, that the thermal discharges may interfere with the fishes' reproductive cycle.

"It would even be useful scientifically to have the fish die 'dead' from the heated effluent," Dr. Witt reports, "but this has never happened. We are working just at an optimum temperature—maybe a little above for fish. It is a gray area for research. So far, we have no positive conclusions, but we will try to stay with it until we do."

Meanwhile, fishermen have benefited in one area of the reservoir because the warm water effluent keeps an arm of this body of water free of ice in the winter where fish congregate. Also, researchers believe the thermal loading may foster development of a catfish culture and are investigating that possibility.

America's flight to the suburbs has contributed to another water problem in which OWRR is involved—the eutrophic lake. This is a lake that is overly enriched. While a small suburban lake may be a real estate salesman's dream for enticing city dwellers to buy country property, such lakes have a tendency to become covered with weeds as a result of nutrients poured into them by lawn runoff and other drainage. When aquatic plants die they use dissolved oxygen, become unsightly, produce odor problems, and cause fish to die.

Property owners on the shores of eutrophic lakes in southern Wisconsin are among suburban property owners made aware of weed problems. They also have been concerned about the quantities of poisons that have been poured into their lakes in an unsuccessful attempt to control the growth. In desperation they called in Dr. Stanley A. Nichols of the University of Wisconsin's Department of Botany.

As a consultant, Dr. Nichols prepared a research proposal which eventually was funded by an OWRR grant through the Wisconsin Water Resources Center. Later, building on research by Dr. Nichols and Grant Cottam, also of Wisconsin University, three other researchers—H. D. Bruhn, an agricultural engineer; D. F. Livermore, a mechanical engineer, and R. G. Koegel, of the Water Center—set out to devise ways of disposing of the weeds without chemicals. With the backing of the public and industry they obtained the funds and equipment to carry out their experiments.

The investigators discovered that mechanical removal of the excess vegetation was an ecologically sound approach to the problem. But mechanical harvesting is limited by the rate at which it can be handled and disposed of, and by the amount of available equipment.

Much of the equipment used in their study so far has been supplied by industrial firms such as the Clark Equipment Company of Buchanan, Michigan; the Jones Division of the Beloit Corporation; the Allis Chalmers Company; the Outboard Marine Corporation of Milwaukee; the Gehl Manufacturing Company, and the Fox River Tractor Company. Equipment includes mechanical weed harvesters, screw presses to dewater the plants, outboard motors, forage choppers and pickup units. The City of Madison supplied lake vegetation from its harvesting operations and Dane County assumed responsibility for mechanical harvesting in area lakes. The Village of Shorewood Hills loaned the project its aquatic vegetation cutter when needed.

Seminars and public demonstrations of the methods to harvest and dispose of the weeds have been held. Weeds taken from the lake are fed into a machine that dewateres them and divides them into two components—a press residue (about half water and half fiber) which can be used as a mulch for lawns or composted for subsequent use as a soil conditioner, and a thick green liquid from which a protein concentrate may be made. Work is now underway to establish the nutritional potential of the harvested plant material, some of which may be feasible for use as a livestock feed.

* * *

The Conservation Foundation of Washington, D.C., and the University of Miami have pooled resources under

an OWRR grant to try to answer the question, "How can there be urban development without degradation of the environment?" Their research is focused on the beautiful Rookery Bay area of Florida, site of a National Audubon Society sanctuary, which is also attractive to land developers.

A research team which includes Arthur Davis, Vice President-Operations, and others of the Conservation Foundation, and Dr. Durbin Tabb and B. J. Yokel of the Rosenstiel School of Marine and Atmospheric Science, plus other scientists from the University of Miami, University of Florida, and elsewhere, are developing methods for collecting and packaging biologic, physico-chemical, ecologic, hydrologic, water quality and socio-economic data for use by planners and decision-makers.

Their findings already have benefited the planning and development of the Naples, Florida, area to handle a balanced population growth while preserving environmental values. With OWRR assistance, the investigators hope to develop procedures and create predictive models that can be applied to other coastal areas with similar problems.

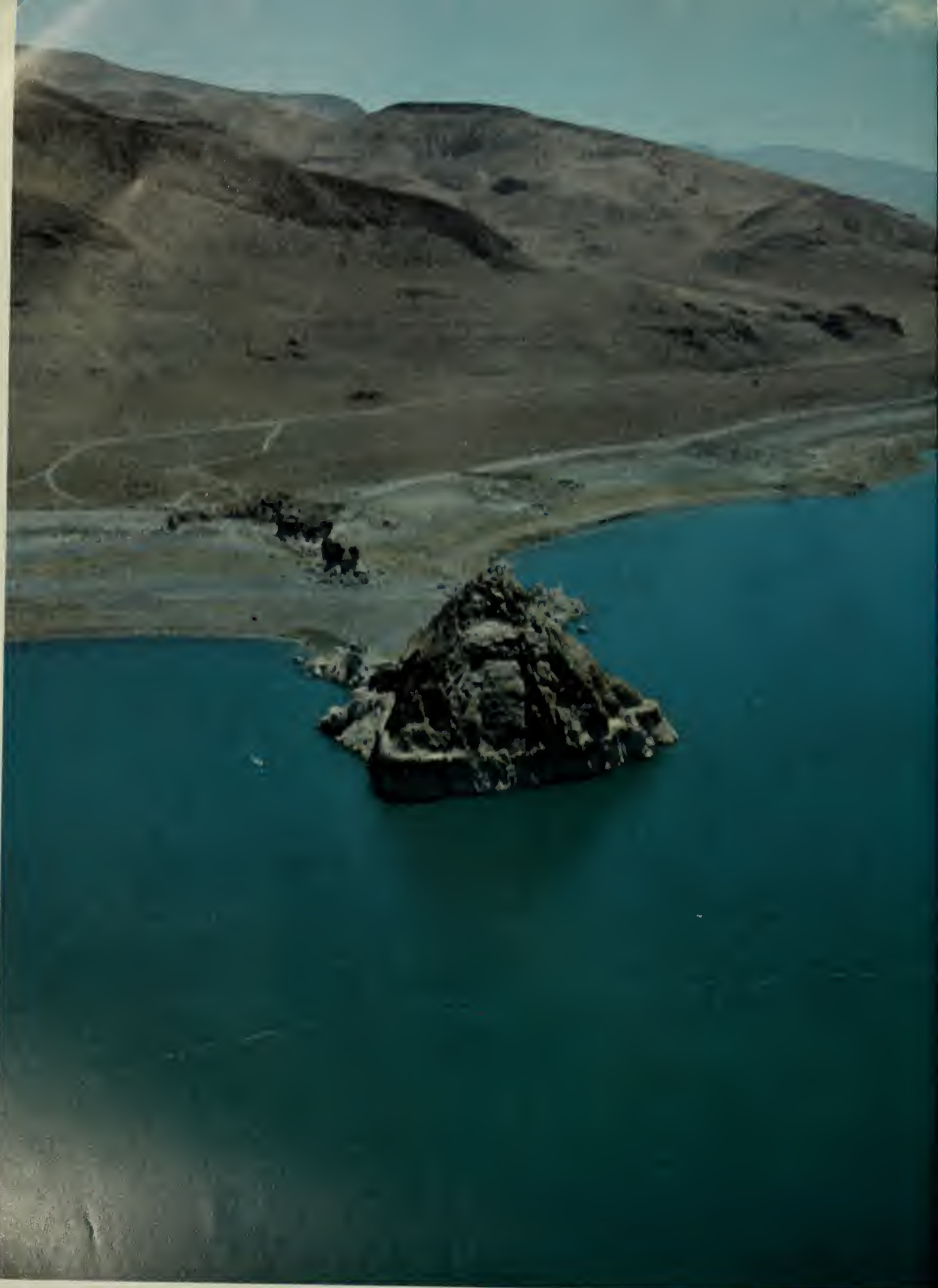
Research sponsored by OWRR helps solve water management problems not only in populated sections of the country, but in sparsely settled areas.

In 1972, OWRR arranged for a grant to the Tribal Council of the Quinault Indians of the Washington coast. Although the Indians had inhabited the forests and watersheds of Washington for generations, they sought better ways to manage their resources.

With the grant, the Tribal Council and investigators are working toward three objectives: development of a better understanding of the interrelations of forestry and fishery resources, which are the bases of the Indians' economic growth; development of a sound and scientific method for managing their waters; and the training of Indian people to be managers of their resources. The latter would be done by using technicians and undergraduate trainees as student research assistants on a project, and in conjunction with local college programs in fisheries and forestry.

The most recent progress report of the project indicates that the Quinault tribal leadership is aiming at compatible development of watershed resources, "and as such we see our research effort as helping to accomplish that objective."

IV INDIAN AFFAIRS



Toward Self-determination

Pyramid Lake, Nevada, around which the Pyramid Lake Paiute Indian Tribe lives. The lake received its name from the characteristic rock that rears up through the blue-green water. John C. Fremont wrote that there was "a very remarkable rock in the lake . . . it rose according to our estimate 600 feet above the water and, from the point we viewed it, presented a pretty exact outline of the great pyramid of Cheops." (Bottom) Wayne Boyd, left, a 23-year-old member of the Colville Confederated Tribes of Washington State, learned to operate heavy construction equipment in the Bureau of Indian Affairs' Indian Action Team Program. Eddie Palmanteer, Assistant General Manager for Colville Indian Tribal Enterprises, right, believes that IAT trainees have a good future on the Colville Indian Reservation.



The relationship between the original inhabitants of the North American continent and "newcomers" is this Nation's oldest legal and social issue. But the issues calling for solution today are not those of yesterday, nor are the policies and the programs of the Federal Government that deal with it.

President Nixon has said: "The First Americans—the Indians—are the most deprived and most isolated minority in our Nation. On virtually every scale of measurement—employment, income, education, health—the condition of the Indian people ranks at the bottom."

In indicating that the policy of the Federal Government be one of self-determination on the part of Indian people without termination of their special relationship to the Federal Government the President added: "This, then, must be the goal of any new national policy toward the Indian people: to strengthen the Indian's sense of autonomy without threatening his sense of community."

Through treaties and agreements, a special relationship has developed between the Federal Government and American Indians living on trust lands. Because it is trustee of Indian lands, the Interior's Bureau of Indian Affairs provides a variety of programs and services to about 488,000 Indians on trust lands, usually called reservations. Another 350,000 Indians live away from the reservations in cities, towns, and rural areas.

Wide variations in tribal culture and experience make it difficult to generalize when discussing Indian communities. In some ways, however, Indians share a common experience as all have been affected to some degree by the dominant society. In the last few years there has also developed a mutual bond between tribes in their belief that Indian people should take over the direction of their own affairs. Many Indian tribes have demonstrated their ability and willingness to translate the President's self-determination goal into reality for the benefit of their people.

"Gift of the Gods"

The Confederated Tribes of the Warm Springs Reservation in Oregon is the largest single employer of its own people. This does not imply, however, that tribal members have no option other than staying on the portion of land of the often sunny eastern slopes of the Cascade Mountains they own. At least other choices have been open to Kenneth Smith, a 1959 graduate of the University of Oregon in business administration, who is general manager and council secretary of the tribe.

Ken Smith is the guiding hand behind Kah-Nee-Ta, "Gift of the Gods," Lodge as he also handles the business affairs of the tribe. The reservation he works on and partially owns was established by treaty with bands of the Warm Springs and Wasco Indians in 1855. This group now numbers about 1,640 and lives side-by-side with about 130 Paiute Indians who came to Oregon in 1866.

Warm Springs Indians voted in 1938 to assume the management of their own affairs; the BIA has remained only as an advisor and as trustee of the reservation lands. The tribe governs itself with three chiefs and eight elected representatives under tribal President Olney Patt.

Active economic life on the reservation—and Kah-Nee-Ta—actually began in 1956. That year, the Federal Government paid the tribe \$4 million for the loss of its ancestral fishing grounds at Celio Falls on the Columbia River which were inundated by the Dallas Dam Reservoir. Two years later, this energetic and far-sighted group paid \$100,000 to Oregon State University for a two-year study of the reservation's potential for development.

The late Vernon Jackson, a Wasco Indian who preceded Smith as general manager and council secretary, was captivated by a study that showed Oregon's great need for facilities to handle conventions of 200 to 300 persons for three to five days. He convinced the Tribal Council that its reservation—with year round sunshine in contrast to less cheerful surrounding environs—was the place for such a convention center. The council decided that the ideal site would be 320 acres of hot springs on the Warm

Springs River—one of the few individual allotments of land once belonging to the Warm Springs Tribe that had been sold outside the tribe.

The non-Indian owner had developed the Springs slightly, with a bathhouse and a pool. The tribe paid him \$165,000 dollars for the land and improvements, and it was this beginning that the Warm Springs Indians escalated into the present multi-million dollar resort.

In 1962, the Area Redevelopment Administration funded a feasibility study of Kah-Nee-Ta Village resort at the hot springs for the Warm Springs Tribe. The following year the Tribal Council acted upon this study. It voted \$750,000 of tribal funds for the resort. It later increased the amount to \$1,074,000 in all, and Kah-Nee-Ta Village was opened on Memorial Day of 1964.

Kah-Nee-Ta Village was popular with visitors from throughout the United States. The Village has an Olympic-size swimming pool and two smaller pools; motel accommodations, trailer parking and camping areas, trout fishing; and, of course, the mineral springs that were the original asset of the site. Teepees were available to house those who came to enjoy the sun, and the Village became a popular youth stopping place.

Two years later, the Tribal Council voted to expand the unit with a convention center and a resort and to call this expansion Kah-Nee-Ta Lodge. A year later, it hired a general manager for this proposed new facility. This general manager is Herbert R. Moller. Moller's father was manager of one of Europe's fine hotels in Copenhagen, and grew up in the hotel tradition. Before joining Kah-Nee-Ta, Moller had supervised construction of hotels for Pan American Airways in Ireland, Lebanon and Guam.

Plans were drawn up for a \$5.1 million resort based upon the decision that the building should be a strong mark upon the land that sweeps up from the tumbling Warm Springs River. It was to be located a mile downriver from Kah-Nee-Ta Village. A Portland, Oregon, architectural firm went to work to see there was an Indian feeling in the building that was to emerge.

A building began to take shape on the juniper-and-sage covered outcroppings. With an arrowhead shape and carved figures that told Indian legends, the building repeated



(Above and Right Top) Kah-Nee-Ta Lodge, a new tourist complex owned and operated by the Warm Springs Indian Tribe, Oregon. The lodge, built at a cost of \$5.1 million, has 90 guest rooms on three swept-back levels of the racing edges of an arrowhead. (Near Right) Three-story fireplace in main lobby of Kah-Nee-Ta Lodge. Each room of the lodge has a balcony that looks down 200 feet toward the rushing waters of the Warm Springs River. (Right Middle) Main dining room of Kah-Nee-Ta Lodge. The lodge has two major meeting and banquet rooms and five other rooms for smaller groups. (Far Right Bottom) Warm Springs Indians invite non-Indians to join them in friendship dance.

the strong colors of the high desert of eastern Oregon. Cedar dominated the outside, and the inside made use of cedar, oak, and ash and featured a three-story fireplace.

Today, the lodge has 90 guest rooms of varying sizes on three sweptback levels of the racing edges of an arrowhead. Each room, from its balcony looks down 200 feet toward the rushing waters of the Warm Springs River. The lodge has two major meeting and banquet rooms, each of which can be divided by pneumatic panels. One has a 185 seating capacity, the other 155. Five other rooms for smaller groups can be used separately or opened into a single larger unit.

It is an American tourism success story, as well as an Indian economic development success story.



Success At Salt River

In October 1972 the Salt River Pima-Maricopa Indian community near Phoenix, Ariz., was awarded the Meritorious Program Award of the American Institute of Planners for its program to improve the social and economic conditions, facilities, and delivery of services at Salt River. The presentation in Boston, Mass., marked the first time in the Institute's history the award was given to an Indian community.

For the Pima and Maricopa Indians of Salt River, this national award, the most prestigious of its kind, is the culmination of five years of concerted effort to produce a planning program for the Salt River Indian Community.

"The success of the planning process at Salt River is due in large part to the people there who have wanted to achieve independence in making their own decisions," states Paul Smith, President of the Salt River Community. Over 90 percent of Salt River's 2,178 citizens have been directly involved in the planning program.

The success story at Salt River is unique among Indian communities for a number of reasons. In May 1968 when the Superintendent at Salt River was transferred, the Pima-Maricopa Community Council decided that rather than select a new Superintendent, the council would assume responsibility for the BIA activities and determine how things should be run in the Salt River Community. "We know the community members and felt that the Council could better relate to their situations and problems," explained Smith.

Although tribal "takeovers" are more customary today, in May 1968 a tribe that chose to leave the protective BIA umbrella and go out on its own was a rare occurrence.

Self-determination for the Indians at Salt River has not been easily or quickly achieved, however. The first obstacle to overcome was the community's need to protect its land base. Almost one-fourth of the 46,626-acre reservation is individually-owned allotted land and ownership of the small

plots is frequently fragmented. The majority of the Indian people live in the western portion on nearly 15,000 acres or irrigated farmland. Although owned by Indians, most of this irrigated land is leased to non-Indian farmers. The area north and east consists of land which could be farmed, if water were available, and the remaining acreage is rolling desert which might be developed for housing or as a recreation area.

A major community problem was outside developers who wanted to acquire community lands at less than the fair market value. With the western boundary of their community contiguous to Scottsdale and 12 miles east of downtown Phoenix, community members knew their strategic location could become a gold mine, provided a responsible community development plan was initiated. Without such a plan, their homeland could soon become another sprawling suburban area in the fast-growing Phoenix megalopolis. The people at Salt River came to realize that if anyone was going to protect their land base it was going to have to be them.

In 1967, the Council assumed from the Bureau the management of reservation property and formed a Land Management Board, headed by Billman Hayes, Sr. The Council delegated authority to the Board for establishing a system of controls for the leasing and selling of Indian lands at Salt River. In addition, the seven-member Land Board has jurisdiction for the community's utilities and roads.

The Board recommends approval or disapproval of leases involving both tribal and allotted lands. Hayes says few leases pass the critical eye of the Land Board. All leases must be in accord with the zoning regulations and development standards established by the Council. If recommended by the Board and approved by the landowners whose land is involved, the leases are then reviewed by the Council. Final approval is made by the BIA.

"Those people interested in leasing Indian lands come to the Board and we help the landowners determine what effect the lease would have on the community and the surrounding areas," said Hayes.

In 1968, the Salt River Community hired a planning firm with planning funds provided by the Department of Housing and Urban Development to prepare the development plan for the community. Numerous meetings were held involving the Council, the Land

Board, churches, and tribal members to translate the community's goals into an overall community plan. There was continual consultation between the firm and the tribe in planning the document, and in 1971, the Salt River Community Council adopted a General Development Plan which included land use guides and development standards.

Today, the community at Salt River has become a model of communal resourcefulness and dedication. Under the new plan, Salt River now boasts one industrial park, improved housing through the efforts of the Salt River Housing Authority, a community center with gymnasium and new educational programs. In addition, the Community adopted a new Constitution, reorganized its community government, and adopted a six-year Capital Improvement Program. Salt River also hired its first full time Planner who works closely with the Council, the Land Board and the Community's planning consultants.

Assuming direction of their own affairs has caused a dramatic shift in the type of government at Salt River — from a traditional Council-BIA administration to a form of departmentalized governmental body, presided over by a nine-member elected council, but staffed with paid professional and technical employees. The Community Council is responsible for policy-making, financial developing and program evaluation while management of daily administrative responsibilities are delegated to the Council President, Vice President, and Community Manager.

As technical advisors, 40 BIA employees at Salt River assist President Smith and other officials of the Indian community in this overall program. To date, the community has responsibility for most programs except the day school, roads and the irrigation project which are administered by BIA.

A proposed governmental office complex near the existing community center will provide space for the Council, BIA offices, a law enforcement and court system, public safety office, medical training complex and motor pool. The complex will also support an intensive training program for local residents to upgrade their earning potential in public service careers. Construction and development of an alcoholism center and a rehabilitation center for law and order are also planned. Another short-term

goal is the development of an overall educational system with plans to construct elementary, junior high and high school complexes.

A large share of the credit for the community's extensive involvement in community affairs must be given to President Smith, who assumed that position in June 1971. One of his first official changes was to initiate the practice of monthly community meetings in which the Council and community members can interact on matters of importance.

What brought about the change of attitudes at Salt River?—President Smith believes that the change, which has been a gradual one, is due in part to the adoption of a long-range development plan for the reservation and the establishment of community goals.

"Five years ago we decided to take definite steps to preserve and maintain use of our land. We are still in the process of implementing these plans, but the basic format is laid out. Each year we are attempting to meet the short-term goals that can lead directly to achieving our ultimate goal—to become a self-sustaining community that can stand on its own two feet and direct its affairs as it sees fit."



(Right) (1) Tom Romero, Governor of Pojoaque Pueblo, and a citizen at the Pueblo Plaza where Indians operate or lease land for businesses. (2) View of Tesuque Pueblo bridge construction. (3) Reconstruction at Tao Pueblo. (4) BIA project—school under construction, Tesuque Pueblo.

Indian Water Rights

Because the Federal Government is the trustee of Indian lands and has responsibility for other land or land-oriented agencies — such as the National Park Service and Bureau of Land Management, it has sometimes been both advocate and adversary in matters that affect the Indian land base. This is nowhere more evident than is the matter of Indian water, an issue of particular importance since the majority of Indian reservations are in arid sections of the West.

To strengthen the Federal program for protecting Indian water resources, the Secretary of the Interior created an Office of Indian Water Rights in the Bureau of Indian Affairs. It is charged with the authority to coordinate all efforts of the Department on the subject.

On September 22, 1972, the Solicitor General of the United States, at the request of the Secretary of the Interior, filed a motion in the U.S. Supreme Court for leave to file a complaint on behalf of the Pyramid Lake Paiute Tribe against the states of Nevada and California. The complaint which the United States Government seeks to file asks that a:

"decree be entered declaring the right of the United States for the benefit of the Pyramid Lake Paiute Tribe of Indians to the use of sufficient waters of the Truckee River to fulfill the purposes for which the Pyramid Lake Reservation was created, including the maintenance and preservation of Pyramid Lake and the maintenance of the lower reaches of the Truckee River as a natural spawning ground for fish and other purposes beneficial to and satisfying such use to be with a priority of November 28, 1859."

Grey-green Pyramid Lake, almost as large as Lake Tahoe, is in a tree-less desert 39 miles northeast of Reno,

Nev. Near it is the town of Nixon, a trading area for the approximately 400 members of the Pyramid Lake Paiute Tribe of Nevada that depend upon the lake.

The surface elevation of the lake has dropped 70 feet in the past 70 years as a result of use by upstream diversions or farm irrigation, municipal and recreation projects. Lake waters are the home of the Lahontan cutthroat trout and the Cui Ui, a rare fish considered a delicacy by the Paiute Indians. In fact, for centuries the Paiutes, and other Indians who knew of the lake, spoke of Pyramid Lake as the "Lake of the Cui-ui Eaters." The Paiutes lived in caves and straw huts and ate trout and Cui-ui's, and supplemented their diet with pinon nuts and other gathered foods.

The lake received its second name from John C. Fremont and his party who, moving south from what became the State of Oregon, came upon it unexpectedly in 1844. Fremont reported that there was "a very remarkable rock in the lake . . . it rose according to our estimate 600 feet above the water and, from the point we viewed it, presented a pretty exact outline of the great Pyramid of Cheops."

He described what he saw in his diary as a "sheet of green" breaking "upon our eyes like the ocean. The waves were curling in the breeze and their dark-green color showed it to be a body of deep water. For a long time we sat enjoying the view . . . It was set like a gem in the mountains."

The lake is believed to be a remnant of a vast inland sea which once covered nearly 9,000 square miles of western Nevada. The sea receded as the climate became warmer and drier.

Although the present lake has no outlet, it loses water by evaporation. Water from the Truckee River maintains the lake's level. When the Federal Government set the lake aside for the Paiutes in 1859 as the main portion of their desert reservation, it was with the intention that the lake should provide the Indians with the means for a traditional existence.

By 1905, however, the Bureau of Reclamation, pursuant to the Act of June 17, 1902 32 Stat. 388, had built Derby Dam across the Truckee River. A large proportion of the waters which had been flowing into Pyramid Lake was diverted into the Truckee Canal and then to the desert lands for the Newlands Reclamation Project.

New Approaches

There is no typical work day for Wayne Boyd, a 23 year old member of the Colville Confederated Tribes of Washington. As the youngest of the former trainees in the BIA's pilot Indian Action Team Program at Colville, Boyd quickly learned to operate heavy construction equipment and has since become a trainee in the Teamster's Union. Although his title is that of trainee, Boyd receives \$7.20 an hour, journeymen's wages. After working in Spokane for the winter, he is now working for a private construction company on a road project about 30 miles south of Colville. According to Eddie Palmanteer, Assistant General Manager for Colville Indian Tribal Enterprises, Boyd and the other IAT trainees at Colville may eventually find long-term employment with the tribal construction company.

Wayne Boyd is only one of approximately 1000 Indian men who have learned skills and found employment through the Bureau of Indian Affairs' new training program — the Indian Action Teams. The IAT program got its start in early 1972 when the Bureau announced dynamic new plans to accelerate economic development on the reservations.

To coincide with the move for on-reservation development, the BIA redirected its employment assistance program from its former practice of training Indians in the cities to training Indian people near their homes, on the reservations.

The relocation concept for training Indians had failure built into it. Many Indian trainees and their families were unprepared to cope in the alien non-Indian world. The Government's attempt to encourage assimilation did not work as evidenced by the large numbers of Indians returning to their reservations and worse — the creation of Indian urban ghettos — of those who remained.

"Many of the IAT trainees at Colville tried the relocation program, but were unable to adjust to city life," states Palmanteer. "They returned to the reservation and are now members of IAT," he adds.

The guidelines for a new approach to training Indians were to provide training close to home without relocation, to provide marketable skills for long term employment near home, to tie in



with and enhance the tribe's own development plans, to be economically feasible, and to establish Indian businesses.

These are the aims of the Indian Action Team Program, a new approach to an old problem — training and jobs close to home.

Today, 10 Indian Action Teams are operating throughout Indian country, training approximately 1,000 men. The trainees in the pilot program at Colville were trained as heavy equipment operators and mechanics, carpenters, electricians, plumbers, and engineering technicians. During their 18-month training period, this first group of trainees completed 3 miles of unsurfaced road, given high priority by the local people, and worked in the Omak, Wash. flood emergency. They also contracted with the Corps of Army Engineers to build fishing facilities below Chief Joseph Dam for the Indian fishermen. In 1972, Congress appropriated \$230,000 for the trainees to build a warehouse with classrooms and storage areas, a four-unit apartment complex where about 8 of the 70 IAT trainees now live, and a model home.

Similar IAT Programs teaching construction and maintenance skills have been undertaken by Northern Pueblos Enterprises, N.M.; Cherokee Nation, Okla.; Rosebud Sioux Tribe, S.D.; Kenai Native Association, Alaska; Northern Cheyenne Resources Development, Mont.; Rincon Band of San Luiseno, Rincon, Calif.; Standing Rock Sioux Tribe, N.D.; Salt River

(Left) Pyramid Lake Paiute Indian Tribe is trying to preserve — through legal action — the natural spawning grounds for fish unique to the lake. This hatchery depends upon an adequate water level in the lake, and its water level depends upon flow from the Truckee River.

(Top) Viewing large peppers in Pojoaque Pueblo hydroponic green houses. (Top Middle) Close-up of green houses. (Bottom Middle) Steve McLemore, at right, a Cherokee Indian from Tahlequah, Oklahoma, entered Indian Action Team program at Tahlequah and became an instructor. (Left Bottom) Indian holding adobe brick at Nambe Pueblo. (Right Bottom) Training in carpentry is one of basic thrusts of IAT program at Colville Indian Reservation. Here, group is shown receiving instructions that will be useful in reservation building effort.



Indian Community, Ariz.; and Cherokee, N.C.

A typical Indian Action Team consists of seven instructors, each teaching about 10 trainees in the field of their choice. The make-up of the teams is flexible, however, and varies according to the needs and priorities of the particular community. IAT training is accomplished in three phases. Phase one is the formal classroom work which provides the basic knowledge required for a trainee to advance to the shop application phase, or Phase Two. In this phase, the trainee practices what he has learned in the classroom. In the final phase, Phase Three, the trainees are assigned to actual construction and maintenance projects and acquire the skills required to progress toward the journeyman level of their trades.

Before beginning Phase One of the training, steps are taken by the tribe to identify the objectives of the comprehensive development plan for their reservation and to design an operational plan which clearly states these objectives and all resources available to meet these objectives. Tribes wishing to participate in the program prepare and submit their operational plan to the Bureau. If its plan is accepted, the tribe then recruits the trainees and begins the process of incorporating a tribal enterprise. The Bureau prepares the contract and the corporation signs the contract to begin Phase One of the training.

A trainee spends about 18 months in training. Without the disruption of relocation, the trainee is able to concentrate on his training while living at home with his family. The average trainee is 27 years old, has 10 years of schooling, and is married with two children.

There are always exceptions, however, and Steve McLemore, a Cherokee from Tahlequah, Okla., is certainly one of the more unusual. McLemore is 62 years old and is one of the 70 trainees in the IAT program at Tahlequah. McLemore had been a rough carpenter for years, but found that job opportunities were limited for a man of his age and skills. Not wanting to go on welfare, he said he decided to join the Indian Action Team Program to learn about cabinet making. There was only one catch. McLemore proved to be an excellent teacher and, after becoming a trainee, he abandoned cabinet making and began teaching rough carpentry to younger IAT trainees.

According to Daniel Thaxton, consultant for the Tahlequah IAT Program, McLemore is a great inspiration to the young men. "He teaches them to take pride in what they're doing, not just do the job," said Thaxton.

The main purpose of the IAT Program is to provide Indians with marketable skills and knowledge that will enable them to find long term employment near home. A by-product of the training program is the completed projects the trainees work on during Phase Three in their training. Another important, although secondary, aspect of the IAT Program is the development of an Indian business. Each of the Indian Action Teams is a corporation with the hope of eventually becoming a self-supporting operation.

The Northern Pueblos Indian Action Team is operating through the Northern Pueblos Enterprises, Inc., a corporation owned by seven Pueblos in northern New Mexico — Teseque, Pojoaque, Nambe, San Juan, San Ildefonso, Taos, and Picuris. The IAT Program at the pueblos was initiated in December, 1971, and by June, 1972, 60 Indian apprentices were training to become carpenters, engineers, plumbers, heavy equipment operators, and electricians.

Through the IAT Program, the corporation has built a nine-unit hydroponics division for growing tomatoes and a packing plant where the tomatoes are packaged for local distribution. Among other projects, IAT apprentices have also restored Nambe Mills, Inc., in Pojoaque Pueblo which was destroyed by fire, remodeled private homes, and graded roads.

Although surplus equipment is most often used by the apprentices, BIA funds have been used to purchase a sand and gravel crusher, a concrete mixer and plant, and two Adobe Egg Laying Machines. With these machines, and the natural resources at hand, such as gravel, sand, and pumice, the IAT apprentices are now able to construct new buildings in the traditional pueblo style.

The adobe operation is now in full swing and plans have been made to negotiate with HUD for 110 multi-bedroom homes to be built by the IAT apprentices at an estimated cost of \$4 million. Except for the doors, windows, and accessories, the homes will be built entirely from locally made products. The trainees also are in the

process of building an adobe church at Nambe Pueblo. Today, there are 70 apprentices and 8 instructors in the pueblos IAT program. And, 57 men have been placed in construction jobs in New Mexico after leaving the training program.

Why has the Indian Action Team Program succeeded when so many other Indian training programs have failed?

One reason is that, unlike many past programs, all IAT programs involved the local Indian community from the out-set to the project's completion. Indian input is an essential and integral factor in putting together an Indian Action Team and making it work successfully. Community support has been not only "lip service," but in many instances, it is active cooperation and involvement on the part of the citizens to insure that the IAT Program achieves its goals.

One case in point is the IAT program at Tahlequah, Okla. At the Cherokee National Holiday last September, donations were taken to buy bricks for the trainees to construct a waiting room and chapel for the W.W. Hastings Hospital at Tahlequah. Doctors, churches, banks, lumber yards and building supply stores helped raise nearly \$9,000 in cash, services, and supplies for the project.

Nearly 23 projects, appraised at over \$1 million, have been planned for Tahlequah. To date, 19 projects are completed. These include remodeling of the former Ross School, now the IAT training facility, construction of a 7,200 sq. ft. warehouse, office and shop complex, building roads, and installing sewers and underground electricity for a 180-unit apartment complex. The shop building is now used as a pre-fab shop for low-cost homes and plans are being made to enlarge the facilities. One model home is completed and trainees plan to build 55 more homes, 10 of them in 1973.

While working on these projects, all given priority by the tribe, the men are being trained as auto mechanics, carpenters, electricians, engineers, equipment operators, masons and plumbers.

The Indian Action Team program enables Indian people to construct, operate, maintain, and manage their own facilities — a factor which is consistent with the Bureau's recent policy of turning over the operation and management of facilities and programs to local Indian people.

V TERRITORIAL AND TRUST PEOPLE



The Samoan Way

A simple, innovative program in American Samoa is shooting down an old myth which says that South Pacific islanders won't fish commercially in their own waters. It may well spread to other areas in the South Pacific to increase incomes and give the islanders a more healthful diet.

To a degree, the "islanders-won't-fish" theory has been true in past years. A number of reasons created the belief:

Islanders live in their tight little worlds of sunshine, trade winds, and scenic beauties; they cherish strong family ties, and, normally, their wants are minimal. So they naturally shun commercial fishing when it takes them to sea for days on end.

Most of them have always done subsistence fishing on their village reefs. In this way they supplied the needs of family and friends. Until recently, many of them had no refrigeration nor a commercial marketing system. So fishing was a day-to-day way of life.

More recently American Samoa has become more urbanized. The need for jobs has increased. The Office of Marine Resources began two years ago trying to accommodate local conditions and customs with a system which would mean more fishermen and more proteins in local diets.

A small, inexpensive boat for overnight fishing seemed the answer. So they looked to the Oregon coast where several hundred efficient little dories have created a thriving industry and a dependable fish supply.

(Left) Part of a catch by a Samoan fishing dory, including the tasty spiney squirrelfish. (Above) Two dories of the Samoan fleet in Pago Pago Harbor. A storm over Rainmaker Mountain is in the background.



(Above) One of the fishing dories passes the Pago Pago commercial port on its way out to sea. (Far Middle) A view of Pago Pago Bay from the cable car. (Near Middle) More fish from the dories. (Far Bottom) Hosing down some of the catch. (Near Bottom) Sam Puleasi puts the finishing touch on a dory.

In September, 1971, a grant of \$72,000 from the Office of Economic Opportunity was obtained. In December of that year a team of boat builders and fishing specialists came from Oregon. Early in 1972 the first dory, adapted to local conditions, came off a crude assembly line and began overnighing at sea, with immediate success. A little over a year later, 13 of the spunky little boats were in service.

They are special adaptations of the Oregon craft and now are built by locally trained Samoans. Each is 24 feet long, 8 feet wide, and has a shallow draft of about 6 inches. They are powered by inboard-outboard 130-horsepower Volvo-Penta motors and have a normal range of 100 miles, but can go 200 miles with an extra fuel supply. Empty speed is about 25 knots and they can make 15 knots with a full load. Each has ice compartments with a capacity of 1,500 pounds.

Every effort has been made to keep building costs low. Material runs around \$4,500 and the government subsidizes the \$1,000 construction cost for bona fide fishing groups, most of whom represent a single village. Local financing is available with payments going into a revolving fund aimed at keeping the program going. Each of the boats currently is averaging about three overnight trips per week. The 13 boats are employing about 40 fishermen fulltime and about 15 part-time.

The fishermen use long handlines and most of their yield usually is bottom fish, such as snapper and grouper. They also troll for tuna with some success. Although the program still is feeling its way, success to date has been enough to bring expansion plans.

The National Sea Grant Foundation has approved a grant of \$63,000 for a commercial fishing training course in the Territory's new Community College. It will be matched with about \$36,000 in local funds. Students will spend part of their time in class and part of their time fishing. Some will get training in the U.S. and an extension service will be developed for local village instruction programs.

No one knows where it will end. But the program has proved that a plan tailored to local customs offers success. It has also proved that islanders can and will fish commercially and that other islanders will flock to the markets to buy their products.

The program has helped the Samoan people to better utilize the resources of the sea and develop a method of fishing that agrees with Samoans and the Samoan way of life.

Wings Over Majuro

Modern jets wing their way over a great lagoon that previously saw only sailing canoes propelled by Pacific winds. The jets land on an airfield that had been a winding road lined with coconut groves and underbrush.

The new airfield at Majuro in the Marshall Islands opened in 1972, with United States financial aid assisting the Government of Micronesia in developing the facility.

It will help the Marshall Islands, which are part of the Trust Territory of the Pacific Islands, meet the needs of a growing economy. But the airfield is more than a transport facility. Its water catchment facilities will help relieve constant water shortages in the Islands.

The airfield will have complete terminal facilities and will accommodate almost any kind of craft. It is another example of the United States' continuing effort to help the Trust Territory participate fully in the modern world.

Return of The Sergeant

A special visitor to Guam in early 1973 was greeted at the airport by a cheering crowd of almost four hundred well-wishers, including a representative of the Governor and other business and civic officials. The visitor was not a government official or political dignitary—but he had achieved a certain kind of fame, a year earlier, that brought him to the attention of the world.

His name was Shoichi Yokoi—Sergeant Shoichi Yokoi, a straggler of the Japanese Imperial Army who had lived in a cave in Guam for twenty-eight years, unaware that World War II had ended almost as many years ago.

And there he was, returning as a tourist to the U.S.-owned island of Guam—returning as a tourist to a place where he had spent twenty-eight years

in hiding! He was given a resounding welcome by the Guamanian populace in testament to the human spirit.

The people of Guam were not surprised to see the former sergeant return. In fact, they have seen their island become a tourist center in recent years, attracting people from all over the world and from Japan in particular. Many of Guam's visitors are former servicemen who participated, on both sides, in the Pacific Theater of Operations in World War II. Others are tourists who see in Guam a tropical paradise that, in addition, provides all the modern conveniences and luxuries of a contemporary society.

Guam has also become a honeymoon haven for the Japanese, who flock by the thousands to the islands, especially in September and October. In fact Shoichi Yokoi brought his new bride on his return to Guam.

More than 115,000 tourists now visit Guam annually, contributing to the rapidly-expanding economy of the island. The influx of visitors has occasioned a building boom of hotels, restaurants, and other tourist-related services. More than 1,400 first-class hotel rooms now exist on Guam, and a large number of additional rooms are already under construction to accommodate a growing number of visitors. Similar development has been taking place in other facets of the tourist industry, which now is the cornerstone of Guam's private economy.

For years, the people of Guam depended to a large extent on the U.S. military presence on the island. Today, with the encouragement of the Federal government, they are becoming more self-sufficient and are diversifying their economy into various fields of the private sector, thereby providing Guam with one of the fastest-growing economies in the Pacific.

The Federal government assists through programs such as the Guam Development Fund, which was established to encourage the growth of local industry and agriculture. Federal funds are also appropriated for housing, schools, hospitals, roads and other community services. The Guamanian today is actively participating in his island's growth. He knows that a well-planned and carefully coordinated tourist industry, balancing private investment and government support, means employment opportunity and financial stability and these are features that attract the growing numbers of visitors to the U.S. Island of Guam.



(Left-Top) Japanese honeymooners paddle on the calm waters of Tumon Bay in front of the Guam Dai Ichi Hotel. (Right Top) Nicholas Ucherkemur develops a picture in the MOC dark room. (Left Middle) Tumon Bay at dusk. (Right Bottom) The "fales", or homes, of Samoans are used for 160 early childhood centers in American Samoa. Teachers are parents who receive four months of training. Native materials, such as shells, flowers, hand-made blocks and dolls, are used in teaching children three, four and five years old. (Left Bottom) The well-equipped "duty free" shop at the Guam Hilton Hotel attracts Japanese shoppers looking for goods from home at tax-free prices. (Near Right Top) A sail boat passes the Guam Hilton. (Near Right Middle) Refueling the Air Micronesia DC6 at Yap. (Far Right Top) Oscar DeBrum, District Administrator for Marianas District, Trust Territory of the Pacific Islands at Majure Airport. (Far Right Bottom) The Peoples Bank of the Virgin Islands.



Developing Skills

Nicholas Uckerkemur is unable to hear or speak. It would have been easy for the Micronesian Occupational Center to dismiss him as "untrainable." But it would not have been in keeping with the goals of the center.

So, as with all of its students, MOC spent time with Nicholas — time to discover just what it was he wanted to learn, and then time to teach him the necessary skills.

Now Nicholas is repaying MOC. As a Multi-Media assistant at MOC's innovative Multi-Media department, he can operate any printing or duplicating machine there. But it is his increasing photographic talent that has made him an integral part of the department. It is a part he could not have played if MOC had not been willing to help him develop his potential.

The Micronesian Occupation Center's goal is to provide Micronesians with the skills that will enable them to take part in today's occupations and prepare them for tomorrow's technical developments. MOC does this by providing each student with the opportunity to develop his potential in his chosen field. In the case of Nicholas Uckerkemur, this potential easily could have been overlooked.

As a residential, co-educational, vocational school for high school students and adults, Micronesian Occupational Center is located in Koror, Palau. Not all of MOC's students pose challenges as difficult as Nicholas'. But the approach used in his case is repeated time and again with each student that comes to MOC.

Upon arrival at the school, each student is given a two-quarter orientation program to acquaint him with various fields of training provided by the school. Following this period the student determines, with the aid of both his counselor and his instructor, the trade in which he desires training.

"Help" is a more appropriate word than "teach" at MOC, where each student is given individual attention.

Each student learns by doing — doing work that has genuine and lasting importance for himself and fellow Micronesians.

Four classrooms, for example, were built for Palau High School by MOC students at a cost of \$6,000. With the aid of MOC instructors and students,

a pipeline across the channel in Koror was completed in half the expected time. When the generators which provided power to all of Koror failed, it was students from MOC who rewired a new generator in record time.

Students come to MOC from all of the six administrative districts of the Trust Territory of the Pacific Islands. They usually return to their home islands to work after completion of their training. The interaction of these students is thought by many to be as important to the continuing growth and prosperity of Micronesia as any of the career skills taught there.

Recently given the pre-accreditation category of "correspondent" for one year by the Accrediting Commission for Junior Colleges, Western Association of Schools and Colleges, MOC is designed to serve secondary, post secondary and adult students. In June, 1972, 170 students were graduated in courses of study which included air-conditioning and refrigeration, out-board motor and other small engine repair, building trades, construction, plumbing, electrical work, automobile repair, seamstress work, and business and secretarial services, as well as cooking and waitress services. More than 300 students attended MOC in 1973.

It is the law of Micronesia that an educational system be provided to "enable the citizens of the Territory to participate fully in the progressive development of the islands . . ." The Micronesian Occupational Center is doing just that, helping each student achieve his full potential in a changing society.

The Local Incentive

In the U.S. Virgin Islands, people like doing things for themselves. The formation of a local bank is an example.

The People's Bank had its origins in the desire of the Government and populace of the U.S. Virgin Islands for locally-controlled institutions and industries. Time was when every bank in the Islands was owned or controlled by outside interests, and many islanders felt that no one institution could respond fully to the needs of the community and specialize in serving the Islands' economy.

Early in the administration of incumbent Governor Melvin Evans, a charter was granted for a unique new institution which would require that a majority of its board be local citizens and that local people own at least 51 percent of its stock.

After consultation with the Governor, a special study commission, and the Federal Deposit Insurance Corporation, plans were made for a locally-oriented bank capitalized at \$1,250,000.

Shares were offered at \$2 each, and the response was phenomenal. More than 3,500 residents of the Islands (about 20 percent of the adult citizen population) responded with requests to purchase stock. Because the response to this new endeavor was so enthusiastic, the bank's organizers agreed to increase the bank's capitalization to \$2 million, instead of the originally-planned \$1,250,000. And instead of excluding citizens who missed the deadline for stock purchase, the organizers made it possible for all who wanted shares to buy them.

The first branch of the People's Bank opened its doors in August 1971 on the Island of St. Croix. One month later, a facility was opened on St. Thomas. After less than two years of operation, the bank has deposits of approximately \$25 million. More than 60 percent of the bank's stock is held by citizens residing in the U.S. Virgin Islands, and most of the bank's employees are natives of the territory.

The bank represents the type of investment being sought by the Government of the Virgin Islands as it strives to develop the Island's economy.

In this developmental process, the government of the United States is lending its assistance. Under various government programs, funds are being made available for desalinization plants that will provide an adequate supply of fresh water; sewage treatment facilities that will curtail pollution of Islands' crystal clear waters; and safer highways that will enable residents and tourists to travel with greater ease.

Hospital services, virtually 100 percent school enrollments, a four-year college, and a public safety program are some other developments in the U.S. Virgin Islands. Local autonomy is virtually complete, with a judiciary system, a legislature, an elective Governor and representation (non-voting) in the U.S. Congress.

VI CULTURAL AND ARTS NICHE



Artists And Craftsmen



From its earliest days, the talents of artists and craftsmen have been essential to the fulfillment of the mission of the National Park Service.

Architects, landscape architects, designers, sculptors, writers, illustrators and photographers have shaped the appearance of the National Park System and created the programs and facilities which enhance visitor understanding.

As national parks, monuments, historic sites and recreation areas have increased in number, so have cultural programs including art and folk crafts.

The Service is responding to President Nixon's expressed desire that "the growing partnership between Government and the arts continue to be developed to the benefit of both, and more particularly to the benefit of the people of America."

NPS is peculiarly dependent upon arts and crafts for "interpretation" — those activities which explain the character of the individual park unit — its geology, archeology, plant and animal life, and history.

An increasingly important facet of interpretation is the program known as Living History, which has enriched the visitor experience in some 150 Park System areas. Living History puts costumed people in a setting indigenous to the time in which a site flourished. They may, for example, demonstrate the operation of an ironworks or a gristmill, the firing of



(Left) The John F. Kennedy Center for the Performing Arts overlooks the Potomac River and Theodore Roosevelt Island. (Top) Color holds sway for the annual Spanish Day celebration. (Bottom) Weaving — one of the traditional crafts kept alive at Peters Valley.



(Left Top) At Saratoga National Historical Park, N. Y., living history devotees demonstrate outdoor cooking as it was done in the days of the American Revolution. (Left Middle) "Young Abe Lincoln" — with this drama of a great man's formative years, Ford's Theater delights young Washington audiences. (Left Bottom) From the Grand Canyon rim, painter Wilbur Niewald begins a picture of the world-famous formations of the mighty chasm. (Right Top) The 34th National Folk Festival, held in 1972 at Wolf Trap. (Right Middle) Washington's popular outdoor gallery, "Art on the Mall," enables painters to reach a wider audience. (Right Bottom) The ancient pipe-making craft of the Plains Indians lives as their descendants work the original material at Pipestone National Monument.



cannon and muskets, weaving of Indian baskets, or illustrate life in a military camp, a family farm, or a period home.

Peters Valley or Hens Foot Corner?

In the mountains of northwestern New Jersey, about a mile east of the Delaware River, lies Peters Valley, a small crossroads hamlet just off historic Old Mine Road. At times, the village has been called Hens Foot Corner or Bevans.

When Park Service preservation of the village became known, artisans came to practice arts and crafts which have been part of American culture since Colonial days. In 1970, aided by the New Jersey State Council on Arts, the group incorporated as the non-profit Peters Valley Craftsmen.

Here is a living center devoted to education in crafts, including wood-working, potting, weaving, leather working, and the fabrication of jewelry.

At the center of the village stands a Craft Shop and Gallery where wares are displayed and sold. A summer school attracts visiting craftsmen, and an annual Craft Fair is held in August.

Thus the skilled craftsmen live year round in Peters Valley, producing, teaching, demonstrating, and selling their work.

A popular attraction at Catoctin Mountain Park near Thurmont, Maryland, is a Folk Craft Center. Each autumn, the "Catoctin Colorfest" is held there over a weekend to demonstrate mountain crafts preserving half-forgotten skills like broom making, weaving and spinning, and soap and candle making. Such programs are preserving skills from past cultures which are in danger of being lost.

Of great importance to Living History and to arts and crafts demonstrations is the work of American Indians. West of the Mississippi River, 90 percent of the national parks, monuments and historic sites benefit from Indian contributions of one kind or another.

At Pipestone National Monument, in western Minnesota, visitors watch Indians make pipes from the red pipestone which were used by their ancestors for generations.

Legend of the Red Stone

George Catlin, who from 1829 to 1838 executed his historically priceless paintings of American Indians, told of this tradition he found among the Sioux of the Mississippi:

"Many ages after the red men were made, when all the different tribes

were at war, the Great Spirit sent runners and called them all together at the 'Red Pipe'. He stood on top of the rocks, and the red people were assembled in infinite numbers on the plains below. He took out of the rock a piece of the red stone and made a large pipe; he smoked it over them all; told them that it was part of their flesh; that though they were at war, they must meet at this place as friends; that it belonged to them all; that they must make their calumets from it and smoke them to him whenever they wished to appease him or get his good will—the smoke from his big pipe rolled over them all, and he disappeared in its cloud. . . ."

At Sitka National Monument, Alaska, Tlingit Indians demonstrate arts and crafts of their tribe—carving wood, working silver and beads, carving totem poles, weaving baskets and blankets.

At Grand Canyon National Park, Arizona, Navajo and Hopi silversmiths produce items of silver and turquoise, others of the tribe weave traditional baskets and rugs, and Havasupai tribesmen make wood and rawhide drums.

Other locations of Indian craftwork and sales are Nez Perce National Historical Park, Idaho, Canyon de Chelly National Monument, Arizona, and Olympic National Park, Washington.

Urban Parklands

Each year, millions of Americans journey to the Nation's Capital to visit such shrines as the Washington Monument, the Lincoln Memorial, and the Thomas Jefferson Memorial.

These sites, and the parks of Washington, D.C. are administered by the National Park Service. Here the Service developed "Parks For All Seasons," a program of cultural and recreational activities to make the parks better serve the region's needs.

In view of the Lincoln Memorial, artists work, while visitors stroll the sidewalks, enjoying the products of these talents. . . .

Elsewhere, Spanish-Americans sing native songs, or Scandinavians display traditional costumes and foods. . . .

In a wooded setting on the city's outskirts, members of the National Symphony Orchestra entertain campers and park visitors. . . .

These are a few of the programs that thousands saw and heard in 1972. The emphasis was on the arts, and the public responded with enthusiasm in settings which varied from the



Cultural arts presentations and "Living History" dramas are top attractions in many National Park Service areas. (Top) The Ukranian Dance Company, one of the internationally-acclaimed presentations for Wolf Trap's 1972 summer season; (Left Middle) National Symphony Orchestra members wear comfortable summer garb for popular "Summer in the Parks" concerts; (Right Middle) Indian dances at the National Folk Festival held at Wolf Trap Farm Park for the Performing Arts; (Bottom) Washington area painters display their works on the Ellipse near the White House.



Hopewell Village National Historic Site in Pennsylvania is one of the finest examples of a rural American 19th-century ironmaking village. (Top) Casting house, store and barn; (Left Middle) The blacksmith's shop; (Right Middle) a "Living History" demonstration of early American rug-making; (Bottom) a Civil War artillery demonstration at Petersburg National Battlefield in Virginia. Petersburg was the center of railroads that supplied Richmond and General Robert E. Lee's army.



larger National Parks of greater Washington to smaller parks that dot the downtown city.

An especially popular project, "Art on the Mall," transformed the sidewalks of the Reflecting Pool into an outdoor art gallery each Sunday in the summer. Some 1,300 artists displayed their works as another 57,000 persons came to view them.

"Some visitors came time and time again," said Mrs. Maxine Marshall, a professional Baltimore artist who seldom missed an afternoon herself on the sidewalks.

Mrs. Marshall estimates she is one of about five persons in the United States who works in "encaustics," a medium that is "so old it is almost new."

"I was interested in showing my works in the Washington area," she said, "and Art on the Mall gave me the opportunity to expose this medium to a new audience." Several thousand persons saw her paint with the 2,000 year-old technique in which a heated beeswax mixture is used.

Attracting a wide spectrum of support—from the diplomatic community to the neighborhood resident—are several ethnic day programs organized each year in cooperation with Parks For All Seasons.

Visitors to Nordic Day may see natives of Denmark dance, a group from Sweden serve samples of famed Swedish meatballs, and audiences view films of Finland or Iceland.

A transplanted summer fiesta takes place when, on Spanish-American Day, natives of Spanish-speaking nations join as hosts for a celebration to which all are welcome.

Held on the Washington Monument grounds, such events give local citizens and sightseers a first hand look at countries, cultures and peoples.

"Out of the concert hall and into the community." That is how William L. Denton, manager of the National Symphony Orchestra, has described his symphony's Parks For All Seasons summer presentations.

"Clearly, this series has been of great significance to our organization," he said. "And, what's more, the musicians love it."

Several times each week, some 90 symphony members—wearing "Summer in the Parks" T-shirts, not dress clothes—play to audiences in greater Washington. One night their stage may be a campground in Greenbelt Park, Maryland; on another, DuPont Circle, a small tract of

parkland situated in a semi-residential D.C. neighborhood.

Whatever the setting, the orchestra has combined classical and popular offerings to attract capacity audiences to outdoor concerts.

The success of Parks For All Seasons has inspired this program's adaptation in other urban areas. For example, Jefferson National Expansion Memorial National Historic Site, in downtown St. Louis, offered in 1972 many cultural presentations, among them a series of summer concerts by the St. Louis Symphony Orchestra. And the New York District of the National Park Service, presented more than 100 performing arts programs (including six ethnic mini-festivals) attended by some 50,000 persons.

A venerated location in downtown Washington is the restored Ford's Theatre, now a National Historic Site. Here the National Park Service maintains a Lincoln Museum and conducts a Living History program, while Ford's Theatre Society presents stage attractions.

Most famous of the many stage successes brought in by executive producer Frankie Hewitt, was "Godspell," the musical interpretation of St. Matthew's Gospel, which drew capacity audiences to the Ford's stage for more than a year.

Showing his admiration for the production, Secretary Morton personally entertained the young Godspell cast and escorted distinguished guests to numerous performances.

Each winter, some 15,000 Washington-area school children fill the Ford's seats during a three-week period to watch a musical play.

The offering for the most part has been "Young Abe Lincoln," a slice of history put to music that recounts the life of the 16th President from his days as a grocery store clerk to his election to the Illinois legislature.

Produced for the National Park Service by the Performing Arts Repertory Theatre, New York, "Young Abe" has become something of a tradition.

"Young Abe Lincoln" has inspired many letters of thanks containing sentiments like this:

"The best part was when Abe Lincoln and Frank Armstrong wrestled . . . It was the funniest play I have seen. I started to cry when Ann Rutledge died. I wish I could see the play ten more times . . ."

Recently, two great performance centers have been built, notably enriching the cultural life of Washington and increasing the importance of Interior Department art and cultural activities.

In 1972, the Congress made the National Park Service responsible for maintaining the John F. Kennedy Center for the Performing Arts, and for its interpretation to the public. The imposing marble structure overlooks the Potomac River and Theodore Roosevelt Island. It houses three magnificent halls: The Eisenhower Theater, where plays are performed, some imported and some produced here; the Opera House, for ballets, operas, and other musical productions; and the Concert Hall, home of the National Symphony Orchestra.

In nearby Vienna, Virginia, Wolf Trap Farm Park for the Performing Arts continues to offer premier entertainment for summer audiences. The noted Filene Center—built through the generosity of donor Catherine Filene Shouse—presented a full 1972 schedule including the Ukrainian Dance Company, soprano Beverly Sills, the Alvin Ailey American Dance Theater, "The King and I," with Roberta Peters, and Mozart's "Marriage of Figaro," with Norman Triplett in the title role. A remarkable new presentation was "Tremonisha," an opera by Scott Joplin, the black ragtime composer who died in 1917 without seeing much of his work gain the recognition it enjoys today.

Wolf Trap also found time for its special children's programs of puppet theater, dances, opera and folk music, and for activities of the Wolf Trap—American University Academy Orchestra which brings young musicians from across the Nation for study.

"With the addition of these two performing arts centers," said Secretary Morton, "the Interior Department has added two more increasingly important dimensions to our involvement in the performing arts. We feel we have a decidedly significant role to play in bringing the arts to all people, whether they be full scale productions from the stage of a theatre or arts and crafts in a park."

Summer on the Stage

"Like so many young singers eager to learn through performing, I found the Wolf Trap Company the ideal vehicle."

Carmen Balthrop was talking about her first season with the Company—a group of promising young singers and dancers chosen through nationwide auditions to spend a summer season learning and performing at Wolf Trap.

"What a treasure chest of opportunity it opened for me," Carmen said.

Wolf Trap Company is one of the activities of the Nation's first national park for the performing arts, which during the summer season focuses not only on presenting top-rated productions at Filene Center, but also on bringing in talented, youthful performers.

"I worked with informed and already acclaimed people," Carmen Balthrop said, "while at the same time receiving a great deal of exposure."

Like so many artists, this young singer has gone from Wolf Trap on to other productions—and now on a professional basis.

Cooperation for Culture

Beyond its own cultural affairs activities, the NPS cooperates with other organizations and groups to further arts and crafts programs.

"The aim of the National Park Service," says Director Ronald H. Walker, "is to choose art-related programs that provide appropriate, useful and measurable benefits to the park visitor and to surrounding communities. Some programs involve cooperation with entities such as the National Endowment for the Arts, State, county and municipal governments, and private groups."

Folk Festivals

Since 1970 the National Park Service has contracted with the National Folk Festival Association, which provides counsel on ways of enriching Living History programs and cooperates in the presentation of folk activities such as the 34th National Folk Festival held in 1972 at Wolf Trap.

The Nation's first regional folk festival was presented in 1972 in Seattle. The Pacific Northwest Regional Office of the National Park Service acted as catalyst, and sponsors were the Seattle Center, the National Folk Festival Association, the Greater Seattle Folklore Society, REACH (an organization of senior citizens) and others.

The Festival embraced all disciplines of folk music and dance, and included

substantial American Indian participation. Some 250 artists played to combined audiences of 140,000 persons.

Seattle's great success led to formation of a corporation to present regional festivals annually. And several other prominent American cities plan like ventures.

Parks, Arts and Leisure

Designed to expand leisure opportunities of high quality, the Parks, Arts and Leisure Project is sponsored jointly by the National Endowment for the Arts, the National Recreation and Park Association, and the National Park Service.

A major goal is to develop the impetus, the tools and the groundwork for stimulation of a creative partnership of the arts with parks and recreation. The project brings together those with professional skills related to arts and parks to focus on ways to utilize in parks and recreation areas the resources of artists and arts organizations.

First of the project's several phases was a Washington, D.C., conference in November, 1972, where ten regional conferences were planned to develop guidelines to assist State and local governments that wish to advance arts-recreation programs.

Artists in Residence

Blending artistic and park interpretive activities, national parks, monuments and historic sites have been hosts to "Artists in Residence." Last summer, at Grand Canyon National Park, Arizona, such an artist was supported through the cooperation of Artists for the Environment, the Union of Independent Colleges of Art, the Grand Canyon Natural History Association and the National Park Service.

The artist worked on both the north and south rims of the canyon, painting oils and watercolors. Performing an important interpretive function, he conducted both outdoor and indoor seminars devoted to landscape painting.

Art Season at Grand Canyon

Serving in the summer months of 1972 as artist in residence at Grand Canyon National Park, Arizona, Wilbur Niewald had his picture taken "at least a hundred times."

Niewald is chairman of the Painting Department of the Kansas City Art Institute. At Grand Canyon, he worked outdoors, doing both oils and watercolors. Of intense interest to park visitors (and to him) was the problem

of capturing colors which continually change as the light shifts in the great chasm of the Colorado River.

When not painting, the artist conducted seminars for park patrons, some with slides showing stages in the development of his pictures.

For Niewald, his wife and daughter, 19, their stay at the park was a revelation. "They were so good to us," he said of Grand Canyon park personnel. From the interpretive staff he learned much: not only of the beauty of the park but of ecology as well.

The visit was also an important professional experience for Niewald. For two years his painting had been of concrete subjects—nature and still life—rather than abstract, and his Grand Canyon stay came at "an ideal time to fulfill something needed in my work."

The last week he staged an exhibition, even though the pictures were unframed, unmatted, and in some cases wet, as he made last-minute improvements.

Wilbur Niewald's Grand Canyon experience was an opportunity for enrichment—of the experiences of park visitors, of his own understanding of the natural world, and of his artistic development.

The Frontier Painters

Yellowstone National Park, the world's first national park, became one hundred years old in 1972, and President Nixon proclaimed the year National Parks Centennial Year.

Among the events of celebration were art exhibitions presenting works of painters who accompanied expeditions into the wilderness of the American West—pictures influential in the establishment of the early national parks.

In Washington, D.C., the National Collection of Fine Arts, Smithsonian Institution, presented "National Parks and the American Landscape," a collection of 150 oils, watercolors, drawings and memorabilia. Alfred Frankenstein, of the *San Francisco Examiner and Chronicle*, praised this as "one of the most remarkable exhibitions of the year to be held anywhere or for any occasion."

Colorado State University, at Fort Collins, showed in its Center Gallery 45 works under the title "Thomas Moran—in Yellowstone."

Both these exhibits included paintings owned by the National Park Service, by museums, and by private collectors.

Indian Painters/ Sculptors/and Craftspeople

With Native Americans turning increasingly to careers in the professional arts, the Indian Arts and Crafts Board established by Congress in 1935 has recognized the importance of developing cultural institutions with specialized programs directly involving creative Native American artists and craftsmen. Those institutions, in turn, provide valuable promotional and interpretative services by presenting exhibitions of historic and contemporary Native American arts which are enjoyed by more and more people each year.

The Indian Arts and Crafts Board serves as an informational, promotional and advisory clearinghouse encouraging the development of outstanding contemporary Indian, Eskimo and Aleut arts. The Board administers three Indian Museums and Crafts Centers; develops publications on technical and consumer information; provides advisory assistance in planning and conducting demonstration workshops to improve the skills of craftsmen; and helps Native American groups with their production and marketing operations.

During the past five years the Board has worked cooperatively with Indian



(Left Top) Dance breastplate, porcupine quillwork, by Sioux craftsman, Alice Blue Legs; from exhibition organized by Board's Sioux Indian Museum, Rapid City, South Dakota. (Left Bottom) Lucy George, Cherokee basketweaver at work, North Carolina.

artists and craftsmen to begin development and modernization of its three museums—to create the necessary facilities to provide professional innovation in this specialized field of American arts. The museums are Museum of the Plains Indian in Browning, Montana, the Southern Plains Indian Museum in Anadarko, Oklahoma; and the Sioux Indian Museum in Rapid City, South Dakota.

As a first step, in 1969, new and updated semi-permanent exhibitions of historic Indian arts were created at each of the Board's museums, planned and implemented with the cooperation of Indian artists and craftsmen, who also participated by providing a variety of expertise in conservation, documentation and interpretation of the museums' invaluable permanent collections.

These exhibitions of outstanding historic works of art were specially designed to serve as visual resources for continued research by contemporary Indian artists and craftsmen. They present educational and informational displays—for the benefit of both the Indian and general public—of the important esthetic contributions which Native Americans have made to America's many-faceted cultural past.

To promote contemporary works of Native American arts, changing exhibition galleries also were created in each of the museums to provide facilities where Native American artists and craftsmen may schedule showings of their recent creative works. From 1969 to 1972 fifty-four one-person exhibitions introduced the public to talented new Native American painters, sculptors and craftspeople.

With the objective of presenting comprehensive showings of important new aspects of contemporary Native American arts, three major traveling exhibitions were organized to document regional developments of modern works by Plains Indian artists and craftsmen. During 1972 the exhibitions were scheduled on tours of several western states under auspices of State Arts Councils.

The exhibition program at the Board's museums will expand greatly in 1973, as 23 Native American artists and craftsmen have already scheduled showings of their recent works. In addition, a new major exhibition will be developed in cooperation with contemporary Indian craftsmen specializing in a revival of porcupine quillwork, an unusual decorative art media which is unique to the North American Indian.

New Ways of Life

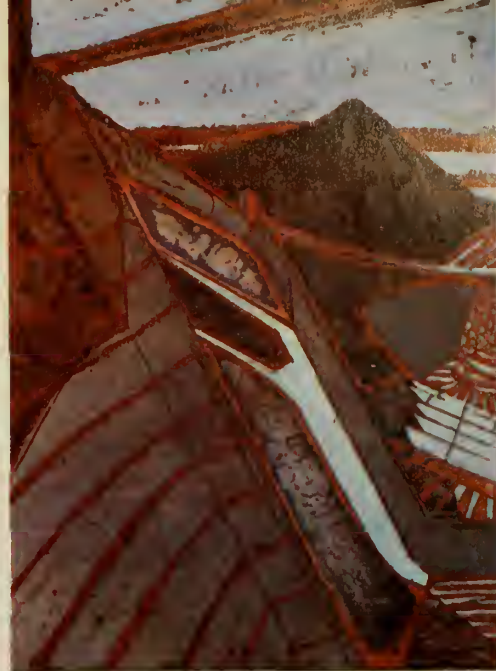
The National Gallery of Art in Washington, D.C., marked a unique milestone in the history of the Federal Government's participation in the visual arts in March, 1972, when it opened an exhibition of paintings created by contemporary American artists commissioned by the Bureau of Reclamation.

The exhibition was the culmination of an art program totally unlike its well-known predecessor, the WPA Fine Arts Program of the 1930s. Anyone whose memory goes back to those depression years will recall that the WPA art program, like so many other combined work and welfare programs of those lean years, was born of an urgent need to provide jobs for the jobless and thereby help lift the country out of its economic doldrums.

But the Reclamation art program was launched with a totally different rationale. A Federal agency was seeking the assistance of established creative artists in conveying the meaning of its programs to the general public. Rather than the Government helping artists—as in WPA days—the government asked the artists for help.

Since the projects of the Bureau of Reclamation are totally concerned with the development and conservation of water resources in our western States, the Bureau's mission can be considered entirely technical. Therefore, it might seem that the addition of an art program to the Bureau's activities is something of an anomaly. The Bureau's mission, however, can be logically considered creative as well as technical—in that the water from Reclamation's developments has changed the face of the American West and brought about new ways of life for its inhabitants. In so doing, the Bureau has created a new environment.

It is this creative aspect of the Reclamation program that the painters were asked to depict. They were never asked to glorify in paint a dam, a canal, a powerplant, or any other man-made structure. They were merely shown around any Reclamation project areas they chose to visit, their questions were answered, and they were free to choose their own



(Top) *Shasta Dam - A Reflective Image*, by Roland Petersen; (Bottom) *Lower Colorado #8*, by Richard Diebenkorn.



subject matter and depict it in whatever style or manner they deemed appropriate. Illumination of the subject matter, rather than illustration of any physical objects, man-made or natural, was the goal of the program.

The artists who were invited to join the program were selected with this in mind. They were told that if they felt their reactions to their material could best be expressed in abstract or semi-abstract terms, this approach would be fully as welcome as the representational. It was made clear that the Bureau wished to commission not their skills alone, but their perceptions and imaginations as well. Since these things must remain entirely personal, no further attempts at guidance were offered. This approach succeeded in

achieving its hoped-for results: the creation of paintings able to stand on their own merits as works of art quite aside from their subject matter.

Some 40 American painters have participated in the art program. They were selected with the advice of Dr. Lloyd Goodrich, for many years Director of the Whitney Museum of American Art in New York City. The commissions offered the painters called for only a very minor sum of money above travel and living expenses while visiting the sites of Reclamation projects on sketching trips; the total was far less than the artists regularly received from sales through their galleries and dealers. Nevertheless the vast majority of the painters invited accepted the proffered commissions.

In some cases the deciding factor was the opportunity to visit some of the most scenic areas of the western United States, and to view those areas by helicopter, boat, jeep, or whatever means of transport would enable them to absorb the total experience. In other cases the compelling motive was the artist's interest in encouraging greater participation in the fine arts on the part of the Federal Government. By making the Bureau's art program a success, they felt, they would be stimulating the initiation of future Federal art programs, perhaps on a larger and more remunerative scale. For this reason participating painters gave unstintingly of their most creative endeavors.

The Bureau's art program was launched in 1969. To date the Bureau has compiled a collection of over 360 oils, acrylics, watercolors, and drawings from the contributing painters. A selection of 70 of these premiered March 25-May 28, 1972 at the National Gallery of Art. The exhibition was seen and acclaimed by thousands of visitors during its stay there.

The Department of the Interior wants America to view the Reclamation art exhibition. To provide opportunities, the exhibition is being sent on a tour of art museums across the country from 1973 through 1976 under the auspices of the Traveling Exhibition Service of the Smithsonian Institution.


Museums that have booked the Reclamation art exhibition and the dates when it can be seen may be obtained by writing to Bureau of Reclamation, Washington, D.C. 20244.



(Left Top) An Artic Grayling, one of the series painted by Bob Hines in the Fish and Wildlife Service. (Left Bottom) Nature photographers receive instruction at Blackwater National Wildlife Refuge in Maryland.

Thousands of years ago early man sketched wildlife on the walls of caves. Today, photographers, painters, and illustrators continue that practice with refined techniques and equipment. (Right Top) Wildflowers, Shenandoah National Park. (Right Bottom) Indian petroglyphs, Grand Gulch, Utah.

Wildlife's Strong Surge



Something like 40,000 years ago humans — presumably early precursors of man — sketched on the walls of their Aurignacian caves those earliest reproductions of wildlife that have been uncovered so far by archeologists and anthropologists.

About 3,500 years ago, the walls of ancient Knossos palaces were covered with mosaics of birds and fishes, and those Cretans of 1,700 B.C. probably got the technique of their art from the Egyptians who were creating Nile wildlife murals before that time. The lion statuary of Mycenae and the jaguar icons of the Toltecs don't look much alike, but they sprang from the same human instinct: to externalize their inner feelings about the other living things that shared space with them; to fix a frozen image that would interpret flowing reality.

The need to fix that image of a living, untamed reality is still in the species self-called man. Cromagnon cave dwellers scratching pigments on their walls by torchlight, or a bank-sponsored tour of painters in 1973, splashing at their canvases on Great Dismal Swamp National Wildlife Refuge . . . is there really much difference?

What draws sensitive, thoughtful people to Chincoteague Wildlife Refuge in April for an art show based on wild animals? Why did the fish paintings of Interior's Bob Hines attract so many people to a Washington gallery? Why are the Audubon bird paintings enjoying new popularity among a wider audience than the solid old "birders" who always looked at Audubon's work — and complained about his inaccuracies? Why the spate of new books and articles on Louis Agassiz Fuertes, almost forgotten only a few years ago?

Not many people have disciplined themselves to see deeply and then,

with blobs or touches of color, to share their experience by making many others see on canvas or paper, but more and more are painting. Not many people have learned how to compose with a camera, but more and more are studying the art.

Huge numbers of people are taking wildlife photographs; last year more than 5 million were exposing film against the light play on waterfowl wings, the white flash of a deer's tail, or the pose of a cardinal at a feeder. An exhibition of portraits of the world's endangered wildlife species, staged in Eastman Kodak's salon in New York, played to packed crowds. Wildlife areas all over the Nation picked up a cue from Blackwater Refuge's photo contest experiment, and amateur exhibitions of pictures flourished over the United States. The quality of entries got better and better, too, according to reports from such refuge managers as Bill Julian, who handles Blackwater on Maryland's Eastern Shore.

Television, too, was discovering that millions of viewers liked wildlife films that were not encumbered with cute little human-interest gimmicks, on subjects ranging from whales beneath the waves to geese against the sky. Professional wildlife managers working for State or Federal agencies found new audiences and began to talk esthetics, along with hunting and fishing. The quality of illustrations, particularly in color reproduction of fine paintings and photographs, has gone up sharply in wildlife magazines.

That same burgeoning interest in art interpretations of wildlife shows in the decades-old "duck stamp" contest to select a design for the migratory waterfowl hunting stamp. Once dominated by a handful of able pros and a scattering of hobbyists, entries have doubled in the last 3 years and judges of the contest (which carries only prestige for the winner — no prizes) estimate that the quality has tripled. Public interest has also gone up markedly; winners in recent years have found a lucrative return from selling their own prints of the designs.

From the Cromagnon "savage" to the American "shutterbug" is not really a long evolutionary step; perhaps all that has changed is techniques. Man still seeks a symbolism that helps him comprehend an elusive reality, no matter what else psychologists make of the strong expansion of interest in art forms and wildlife that has swept the country.

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Protect the environment for present and succeeding generations.

Make wise and beneficial use of the environment without degradation or risk to health and safety.

Preserve and protect the historic, cultural, and natural aspects of our national heritage.

Enhance the quality of our renewable resources.

Recycle our depletable resources.

Seek a balance between population and resource use to assure Americans a high standard of living.

Rogers C. B. Morton

Secretary of the Interior